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Lab Tests of
37 New 19-Inch
Monitors

The Virtual Office

Web Services That
Offer Teamwork
Flexibility

Play-Off Fever

3-D Graphics Make
New PC Baseball
Games a Sure Hit

Handspring Visor ►

Palm OS plus Cool
Accessories Equals
One Hot PDA

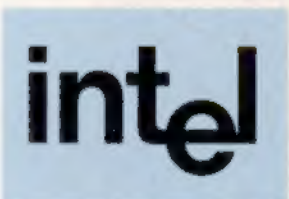
FIRST LOOKS:

- Speech Recognition: Dragon vs. IBM
- Clarion AutoPC
- Wireless WAN Cards -
- eMachines eOne
- Image Editors
- Norton SystemWorks 2000



THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.18 OCTOBER 19, 1999



100 TECHNOLOGY Companies That Are Changing THE World

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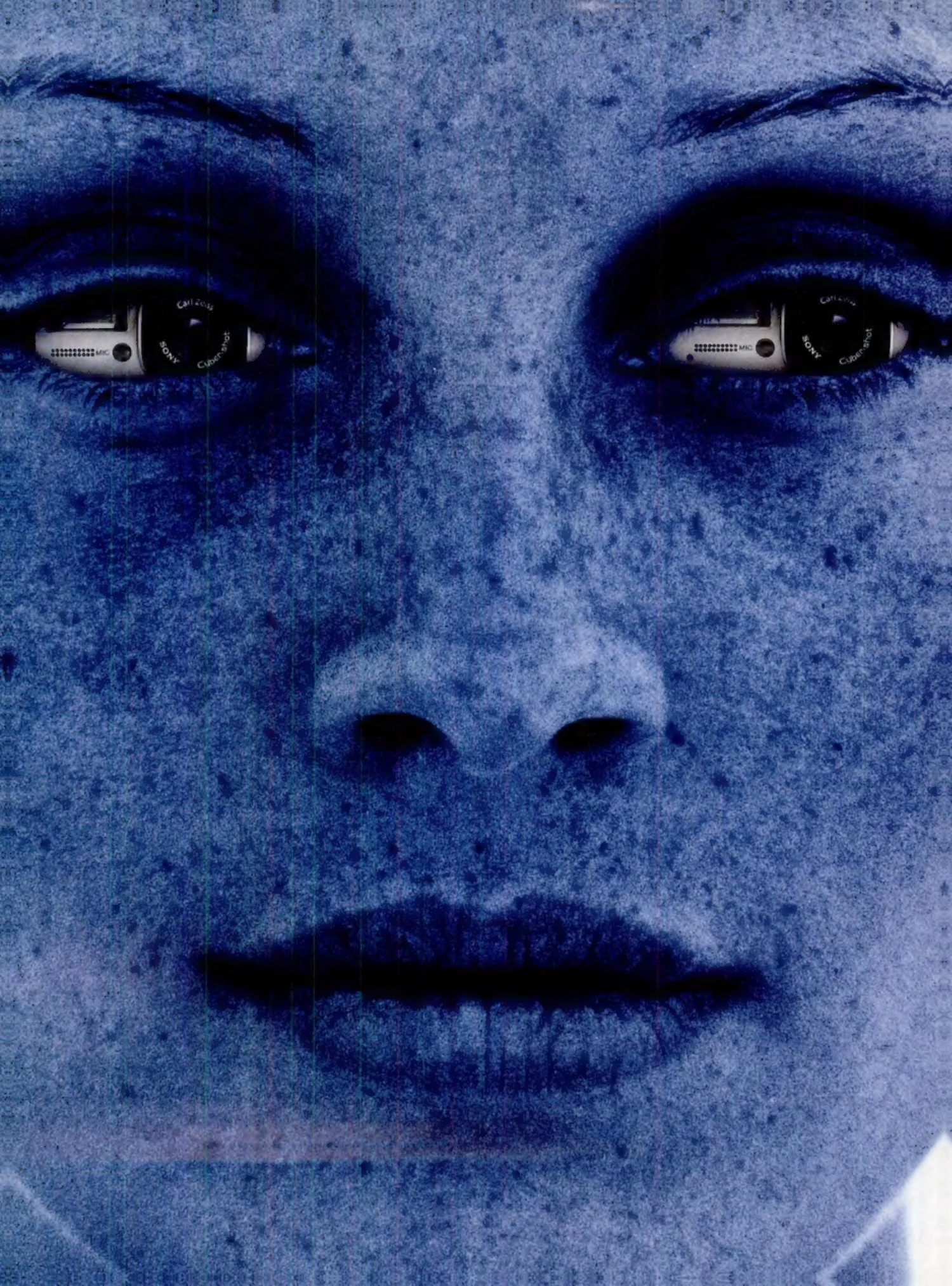
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What Is Influence?

Everyone knows how much the Internet has grown over the past year and how hot Internet stocks have been. But what often gets overlooked is the huge impact that big Internet firms are having on the technology industry as a whole and on just about every player. Our annual ranking of the top 100 tech-

nology companies is an example. There were heated debates among editors, contributing editors, and Labs staff about who really is influential. Nothing was more controversial than where to put the Internet companies: Are they just users of technology, or are they creators whose sites and products affect and influence all of us? The latter point of view won.

These Internet companies are both developing and buying technology to solve problems and delivering technology that changes how we live and work. AOL now delivers more mail than the U.S. Postal Service, thus changing how many people communicate. But AOL needs the technology that lets it do this efficiently. Yahoo! has built a set of personal services that cover all sorts of needs, but it needs the technology to deliver more than 310 million page views a day while adding all sorts of new elements. eBay has defined a new round-the-clock way of letting buyers and sellers get together for all sorts of products. But it needs the technology to deliver 1.5 billion pages per month, continually updated with the most current bids, creating a never-before-seen real-time transaction-processing problem.

These and other Internet-based companies are among the most advanced providers and consumers of new technology. That accounts for their prominent ascension on our top 100 list.

Microsoft tops this year's chart, and that's not a surprise. After all, just about every PC or Internet company has a "Microsoft strategy." You can't say that about anyone else. But as strong as it is, Microsoft doesn't appear quite as dominant as in years past. The Internet has had a democratizing effect, giving power to new companies with new methods. In providing Internet service or Internet content, Microsoft has been competitive, but nowhere near as dominant as it is in operating systems or office applications. And the emergence of new Web-based applications could pose the biggest threat yet to its installed franchise.

A bigger debate was moving AOL into second place on our list ahead of long-time number 2, Intel. Sure, techies may scoff that AOL is a service aimed at the mass market, and others may complain about things like junk e-mail. But it is connecting an estimated 18 million households to the Internet and provides up to half of all the Internet traffic. AOL chat rooms brim with life, and its instant-messaging solutions keep many Net users connected. Its acquisition of Netscape and its joint venture with Sun set the stage for AOL to be a bigger technical player as well.

The other large hardware and software players are far from going away, but they too are increasingly focusing their energies toward the Internet. Intel invests in Internet start-ups and plans to create a new line of Internet-focused chips. IBM has perhaps done more to promote the idea of e-business than anyone, and even Hewlett-Packard is getting into the act, pushing e-services. Servers from Sun and Compaq run most of the big Web sites, and Oracle databases predominate. (See the table "What Makes the Big Sites Run?," page 112.)

That's not to say new CPUs, new PCs, new chips, or even new applications are unimportant. Rather, they provide the crucial technologies needed to move more businesses into the Internet economy.

I expect we'll see more of these mainline technology companies focusing on Internet-specific technologies in the years to come. Over the next year in particular, I expect to see both a lot more consolidation among the big Internet companies and the emergence of many smaller Internet companies. Often the little companies have the big ideas that end up changing the way we do technology.

It all leads to more changes in technology than ever before. And with broadband communications, personalization techniques, remote connectivity, and faster processors all gaining speed, the next year also promises an amazing amount of innovation. **PC**

Are Internet companies just technology users, or are they creators whose sites and products influence all of us?



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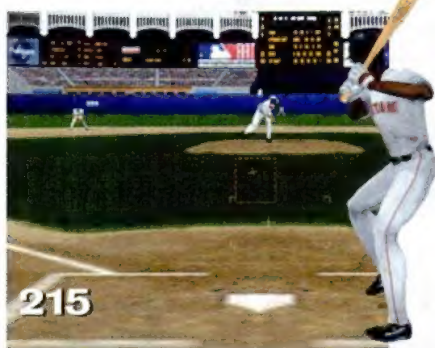
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Cover: Illustration by Tom White; photography by Thom O'Connor



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Our List, Your Way

The online version of our list of the 100 most influential companies is interactive. Sort it any way you want: by rank, by revenue, or by growth.

More on Monitors

We've got much more to tell you about the monitors tested for this issue. Get more monitor facts and figures at our site.

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COVER STORY

94 The Top 100 Companies

The Internet changes everything, including our annual list of the most influential technology companies. See what's moved up, what's moved down, and what's new. We also give you a closer look at the industries behind the list. *By Jake Kirchner*

Special Pullout Section 97

The List: *PC Magazine's* ranking of the 100 most influential technology companies.

19-INCH MONITORS

134 The Big Picture

As monitors get larger and more affordable, 19-inch models are finding their way onto more desktops. *PC Magazine Labs* tests 38 of them, and we tell you which are the best for business, graphics applications, and gaming. *By Alfred Poor*

SOFTWARE

150 The Virtual Office

With just a few clicks and a credit card, you and your coworkers can have a home on the Web: Exchange ideas, share documents, and access your work from anywhere. We help you choose the virtual office that's right for you. *By Larry Seltzer*

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eOne and only: It may look like Apple's iMac, but with its low price, additional features, and ease of use, the eMachines eOne stands apart.

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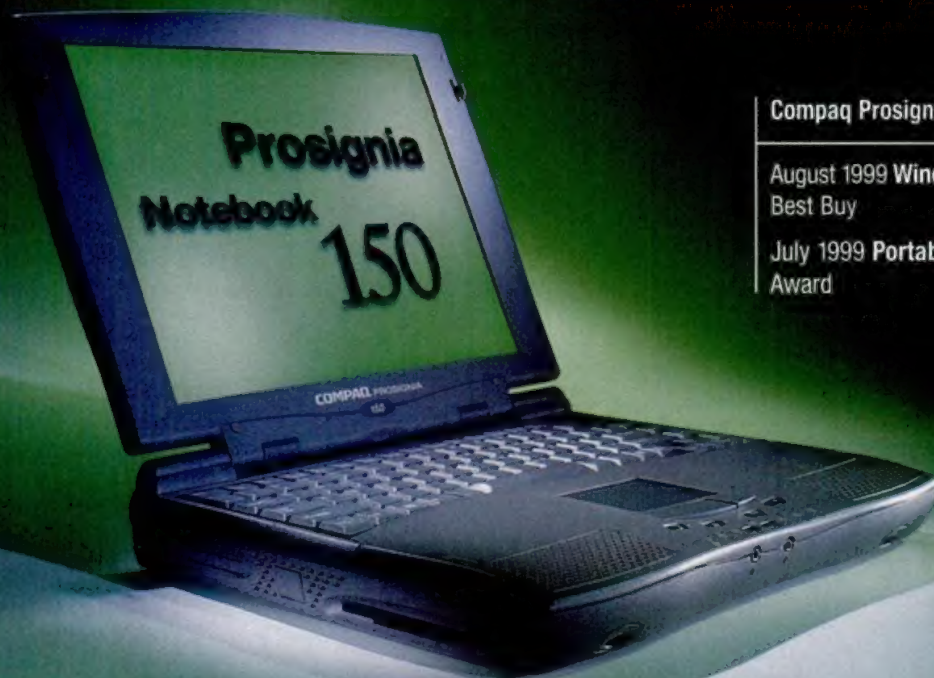
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Compaq Prosignia Notebook 150 Awards:[†]August 1999 Windows Magazine — WinList:
Best BuyJuly 1999 Portable Computing — Lizzie
Award

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- Free[®] Trial of Compaq Online Services
- One-Year Worldwide Limited Warranty[‡]

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- 64MB/192MB SDRAM
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Hey, It's a Concept

Computer designers are starting to think outside the big, boring, beige box, and they're coming up with some rather innovative ideas. Intel recently showcased some of the works in progress from the design firms it has partnered with to transform the stuffy PCs of today.

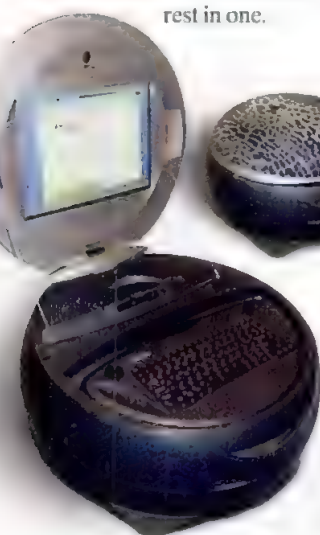
Enter Intel's 900 square-foot "Connected Concept e-Home," and you'll find two sleek concept PCs—the Entrata from Fiori Design Group, and the Polaris from Stratos Product Development. Both provide broadband access for the home via DSL and digital satellite. Step into the living room to see SozoDesign's Ottoman PC, which offers Internet access and a convenient foot-rest in one.



CURVY: Yeong Yang Technology went for curves with its Magic Bean PC.

Another system in the living room, the big-screen Eyris PCTV, pumps in TV, Internet, software applications, and movies. Targeted at the younger set, the Magic Bean, from Yeong Yang Technology, has a DVD drive, mini-speakers, and a headset. The Vesta, developed by Anderson Design, sits on the kitchen counter and offers a touch screen and voice activation.

In addition to driving the industry toward smaller, stylish systems, Intel expects to accelerate the delivery of easy-to-use PCs. Paving the way are Universal Serial Bus, for easily attaching peripherals, and Instantly-Available, which enables the PC to be left on at all times and power down into a deep sleep state when the system is not in use. Companies previewing their easy-to-use concept PCs included AST Computer, Daewoo, Fujitsu, Sony, Sotec, and Toshiba.



SIT ON IT: SozoDesign's Ottoman PC offers a Pentium III, a DVD drive, and interchangeable fabric covers.

As Cheap as They Get

PC prices can't go much lower than they are now, says Intel Vice President and General Manager Pat Gelsinger. Some low-end systems cost just below \$399, but Gelsinger says that component costs and the cost of bundling operating systems is likely to prevent prices from dipping more than \$50 below current prices.

One barrier to further price cuts may be Intel itself. "I don't think that it's in Intel's best interest to expedite the decline of average selling prices in the PC industry," he adds.



of respondents to a recent PC Magazine Online poll told us that their primary home PCs are either brand-new or less than one year old. 41 percent said their systems are between one and three years old, and 16 percent said they're using PCs that are more than three years old.

Sun Buys a Star

The concept of free Web-based applications got a big boost recently with Sun Microsystems' acquisition of Star Division Corp., developer of StarOffice, a suite of office applications. The word processing, spreadsheet, presentation graphics, database, and other apps are strikingly similar to Microsoft Office apps (and can import and export Microsoft files), but there are a few big differences. StarOffice runs on Linux, OS/2, Solaris, Unix, and Windows; it weighs in at 65MB, compared with the 500MB of Office; and it's available as a free download from www.sun.com/staroffice.

The move might appear to be a direct assault on Microsoft Office. But Sun CEO Scott McNealy is positioning the offering as Sun's next step in a long-term strategy to liberate computer users from the endless upgrade treadmill—which is part and parcel of the desktop-centric model of computing—and deliver them to the network-centric model, in which they can access applications over the Web.

In October, Sun plans to launch a site called StarPortal, where you'll be able to run the applications from any Web browser.



FREE SUITE: StarOffice is a multiplatform application suite that doesn't cost a cent.

Your Private Photo Gallery

With Adobe Systems and Hewlett-Packard now in the business of online photography, you've got more opportunities than ever to post, share, and tinker with your family photos. Launching in October, HP's Cartogra site (www.cartogra.com) will bring the company's imaging expertise to the photo-sharing table. You'll be able to store up to 15MB of photos for free; additional space and extra features will be available for a fee. You can upload photos from your PC, digital camera, or scanner; organize them in albums; and e-mail them to friends and family.

Meanwhile, Adobe's ActiveShare site (www.activeshare.com), will let you post an unlimited number of photos for free and send them via e-mail. With the ActiveShare software—a free download starting in October—you'll be able to import photos, perform basic edits, create albums, and write comments on images.

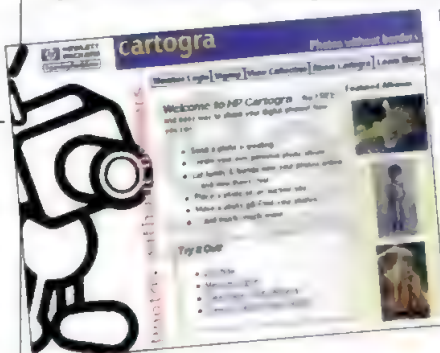


PHOTO FREEMIE: HP's Cartogra site gives you 15MB to display, store, and edit your favorite photos.

Are You a Web Addict?

Do you become restless or irritable when you try to cut back or stop using the Internet? If so, then you may be an online addict. In a recent survey of Internet users, ABCNews.com and psychologist David Greenfield found that 6 percent of Web users—11 million people—are in some way addicted to the Internet. Greenfield's survey assessed Internet use patterns that may indicate compulsive behavior. The results are based on survey responses from over 17,000 Internet users.



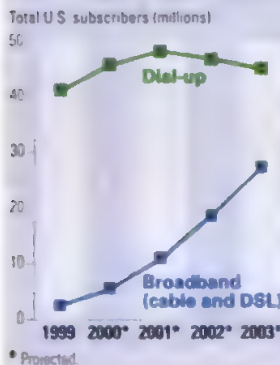
Greenfield concluded the Internet will become a huge productivity problem for employers. He found that people who access the Internet excessively (often up to 40 hours per week) frequently spend a third or more of the workday surfing or chatting. Excessive Web users were also determined to be most susceptible to lies, especially in romantic online relationships. About half of the respondents admitted they had lied online, usually about their age, weight, and marital status.

Broadband Experiments

Broadband Web access, whether via cable or DSL connection, is available only to a fortunate few. Nevertheless, in preparation for the broadband future, Web sites are experimenting with bandwidth-hungry content like video shopping, 3-D games, animations, and movies.

Lycos' HotWired animation hub (www.hotwire.com/animation) has a stable of episodic animations that are already attracting almost 1 million page views per month. Billing itself as the first broadband portal, OnBroadband.com offers multimedia-enhanced information and links to video shopping, live music, sporting events, and games. ZDNet (www.zdnet.com) has video news clips and a Broadband Product Guide. At Snap.com, you'll find links to animations, live events, sports, and television programs. The @Home Network also offers its cable subscribers multimedia content. This fall, look for the launch of the Excite@Home Web site, with streaming multimedia and 3-D shopping. Metafilms plans to debut a full-length feature film called *The Quantum Project* on the Web next May.

Faster Net Connections



Source: Forrester Research April 1999

THIS ISSUE'S CONTRIBUTORS: Carol Levin, Sharon Nash, Sebastian Rupley.

Free Printers

First there were free PCs. Now there are free printers. Lexmark is offering customers rebates of up to \$200 on four of its printers when they sign up for a year of Internet service through Juno Web at \$19.95 a month. Three of the four printers are free with the rebates; the Lexmark Z51 Color Jetprinter will cost shoppers \$49 after the rebate.

Meanwhile, Tektronix is giving away Phaser 840 printers to businesses that agree to maintain a certain volume of color printing per month (the minimum is tailored for each company) and that agree to buy color ink from Tektronix. Fall short of the quota in a given month and you'll get charged \$75. You can apply for the printer at www.freecolorprinters.com.

Top-Selling Retail Games

Half-Life	Havas Interactive
MP Rollercoaster Tycoon	Havas Interactive
Starcraft	Havas Interactive
SimCity 3000	Electronic Arts
Tom Clancy's Rainbow Six Gold Edition	Red Storm Entertainment
Total Annihilation: Kingdoms	GT Interactive
Need for Speed 3	Electronic Arts
Star Wars: Episode 1: The Phantom Menace	LucasArts
MP Mechwarrior	Hasbro Interactive
Monopoly	Hasbro Interactive

Source: PC Data, data for August 1999

Shop Till You Download

Instead of twiddling your thumbs while you download large files from the Web, why not shop? Netzip, a maker of download utilities, thinks it's a great idea and has teamed up with DoubleClick to let you do just that. Available in Netzip 7.0 (\$29.99) and in Netzip Classic (free), Download Demon pops up a window below the download



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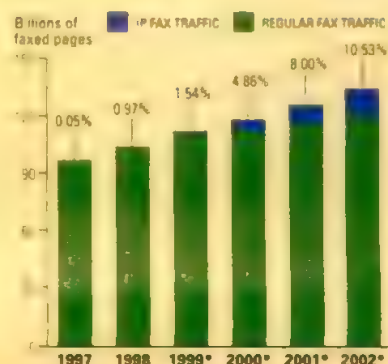
status window and displays options to shop online, play games, look for a job, and read the latest headlines.

You can choose to shop by category or location, or do a search. The games are simple Java applets.

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Internet Fax Traffic

As U.S. companies search for cheaper faxing solutions, they'll increasingly turn to the Internet, according to market research firm Dataquest. The number of Internet Protocol (IP) fax pages rerouted from the public telephone network will increase from 1 billion pages in 1999 to 14 billion pages in 2002.



Source: Dataquest

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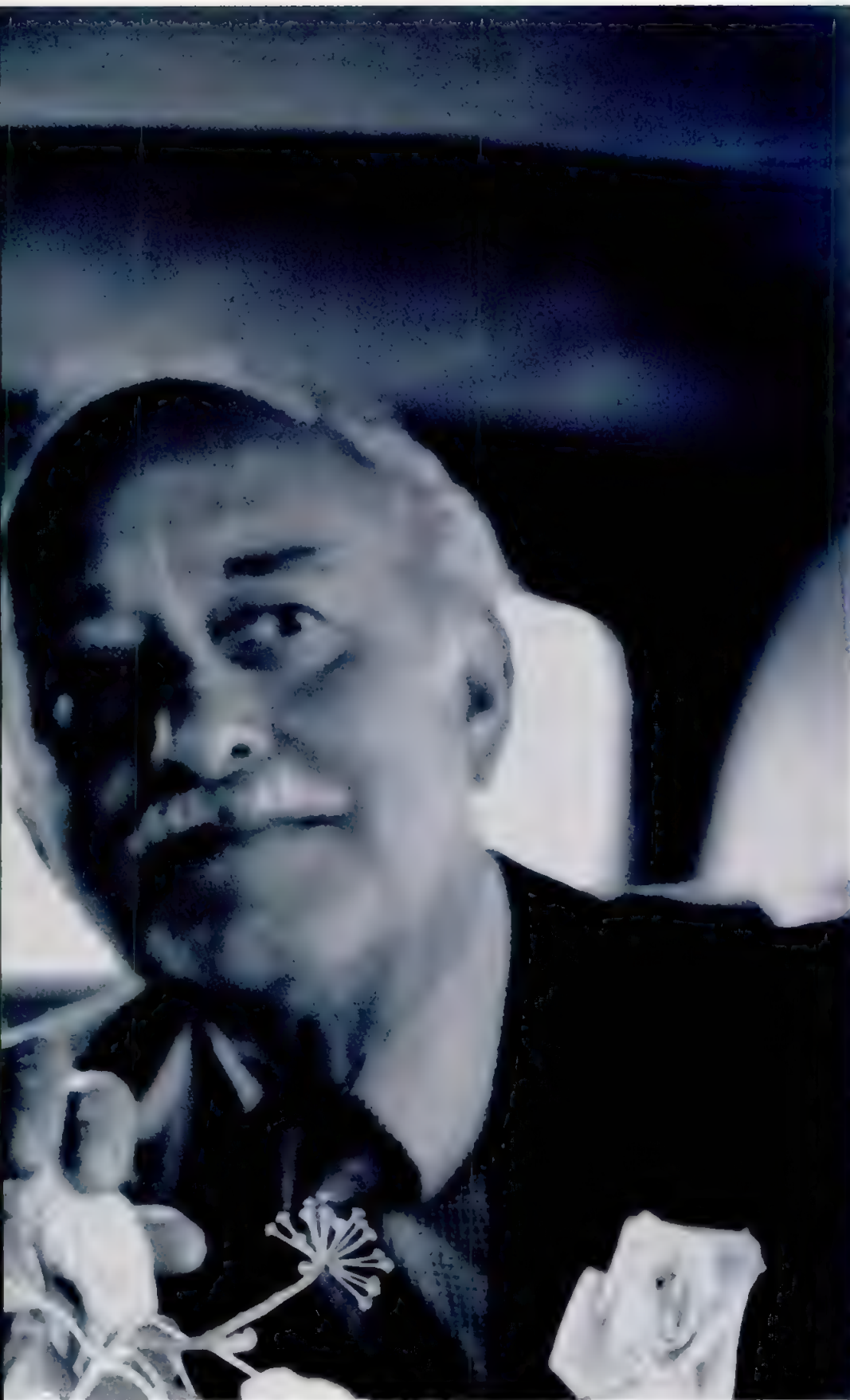
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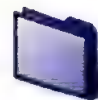
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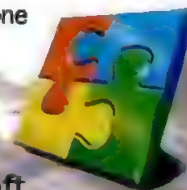
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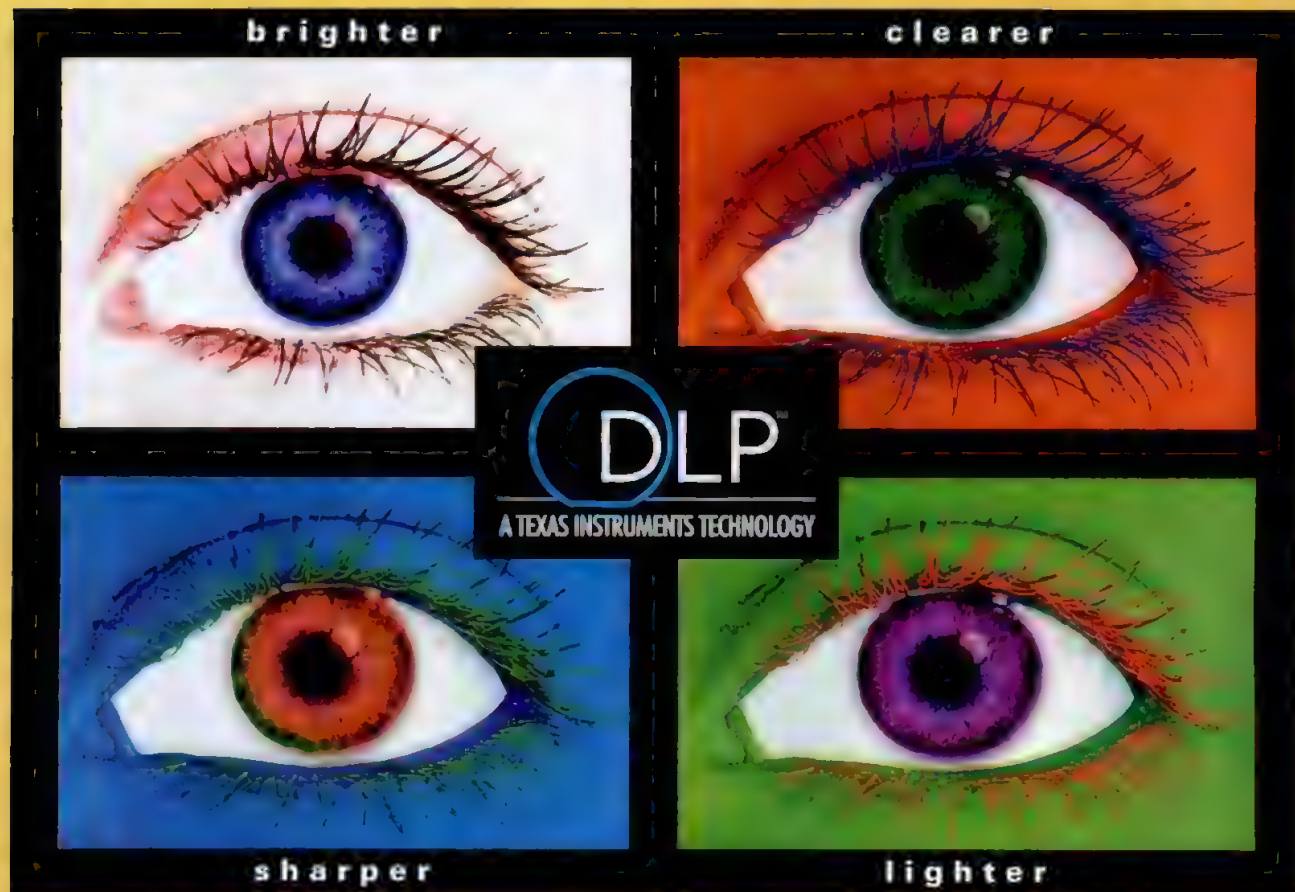


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LETTERS

ONLINE SECURITY

Your recent security feature, "Are You Safe Online?" (September 1), had several useful software reviews, but one thing I wish you had stressed was how insecure a Windows network can be.

I recently downloaded L0phtCrack (www.l0pht.com) and was dismayed to see it crack 20 percent of my users' internal passwords within the first minute. It cracked 50 percent of the passwords within 10 minutes, including those of several domain administrators. I didn't even need any special privileges to get this information; L0phtCrack just listened to network traffic while I was logged in as an ordinary user.

Very few administrators realize that a Windows NT network is virtually transparent to internal mischief-makers, unless 100 percent of the users are running Windows NT (and then only if certain modifications are made to the servers). As I understand it (and I'm a complete novice to this security stuff), the domain servers use an easily cracked algorithm (what L0pht calls a LanMan hash) to encrypt user passwords.

JON HILL
via the Internet

You listed 30 ways to protect yourself, but you didn't answer my biggest concern. I'm sure that all of the large ISPs are ethical and reliable companies with principals who also practice the highest of ethical standards, but what about the unhappy or disgruntled service representative? With my computer now connected to Cox@Home, the luxury of high-speed and continuous connection is undeniable. But an unscrupulous ISP employee could easily see all of my drives, get my passwords, and even see every keystroke I make.

I don't think I'd be protected with even a firewall or a \$7,000-or-more system. So while there is very little privacy left in this world, having an irresponsible hacker working for an ISP who can access all of my financial data as well as other personal items scares the day-

lights out of me. The only way I know of absolutely preventing this is to use two computers—one for online access only, which stores no personal data, and one that I never use for going online. It's a pain, but do you know of a better solution?

ARNOLD BRENNER
via the Internet

As our story outlined, there are some basic steps you can take to protect yourself online. True, no security solution is foolproof. In the cable-access scenario you mentioned, however, you can make unauthorized access more difficult by making sure your system is not configured to share folders and by using strong passwords and encryption. Of course, there are no guarantees online—or in the real

"I don't think I'd be protected with even a firewall or a \$7,000 system."

world, for that matter. Ultimately, you must choose an ISP that seems reputable and trust it to provide reliable, secure service.—Ed.

I just finished reading your article on personal and business Internet protection. I was pleased with the information you presented, but I was extremely disappointed that you jumped from single-user protection to medium- to large-business protection, completely leaving out the SOHO contingent. When I saw that your suggested business solutions ranged from \$4,000 to \$7,995, I was shocked. Most small businesses and home offices can't afford \$1,000 for firewall protection software, let alone \$4,000.

DAN SHEEHAN
via the Internet

The security needs of the SOHO market are important to us, and we'll be covering security from that angle in the near future.—Ed.

A SCANNER IN THE WORKS

For your article "Scanning Made Simple" (September 1), you tested and reviewed 20 low-cost scanners. Since I was in the market for an inexpensive scanner, I read the results of your tests closely. Both Visioneer models were given high marks for good scans and simplicity of operation. This sounded good to me. But to quote the article, "It is interesting to note that while the 7600's PaperPort 6.1 performed flawlessly on our OCR test, Version 5.3.1—which ships with the 5300—failed

the test with more than 25 errors. Visioneer claims it will be updating the 5300's software to Version 6.1." So naturally, I paid the extra \$30 for the 7600.

Imagine my surprise on opening the box to find that I had received not PaperPort 6.1, not even the flawed Version 5.3.1, but Version 5.3. As I did not consider this the retailer's responsibility, I have spent the better part of a day e-mailing and phoning various departments of both Visioneer and the software supplier. As usual, the companies shifted my calls from one department to another, and no one has been polite enough to answer my inquiry. Someone should tell these

people that, contrary to their belief, the FAQs on their sites do not cover every important question.

R. C. BLANKENSHIP
St. Charles, MO

I was pleased to receive your September 1 issue. You highlighted reviews of scanners, and I am planning to purchase one. I was disappointed to discover, though, that your article is mostly text; there are only

two images from the scanners themselves. Since scanners deal with graphics, I would like to see what each scanner can do—before I purchase one. Why didn't you include samples from the lab tests? Most of the numbers provided do not convey a sense of what you would actually see when you scan an image.

REBECCA NEIL
via the Internet

To see lots of sample scans from the scanners we tested, and to compare them against each other and figure out which scanner you like best, see the online version of our evaluation at www.pcmag.com/stories/reviews/0,6755,2307707,00.html.—Ed.

64-BIT COMPUTING

In the September 1 Trends section, the article "Get Ready for 64-Bit Computing" states that "the first 64-bit chips will be for high-end servers and workstations; it'll be many years before IA-64 systems hit desktops en masse."

We've heard exactly the same thing for just about every chip advance for at least the last decade. Then Intel feels market pressure from competitors and realizes that power users want the best, and we've got the new chip faster than you can say *silicon dioxide*. Sure, we might have to put up with a buggy, overly bloated first-generation operating system at first, but that's par for the course. With Intel



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1213

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1591

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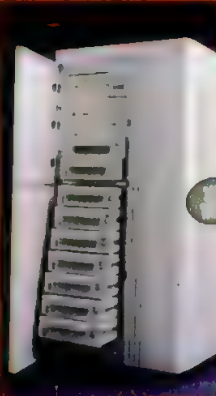
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667



SAMPLE SERVERS



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- 8 MB AGP Video
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- NEW: (3) 5M 9GB LVD 10,000RPM Removable HG
- 32X CDROM/Max. Keyboard, Floppy
- 13 Bay Tower Chassis 400 Watt Redund. Hot Swap Power

6363 WEB CODE: S102
13 Bay Rackmount Solution Avail

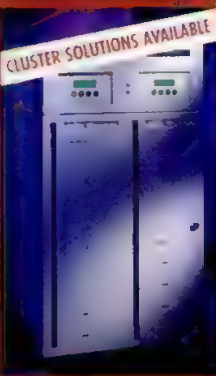
13 BAY PIII 450 RAID

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- 512KB Cache - Expandable to 2 CPUs
- 128MB ECC Memory, Expandable to 1GB
- Slots: (4) 33MHz PCI (2) 66MHz PCI GX Chipset
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- Integrated 10/100 Ethernet
- Integrated 2MB Video
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SAMPLE RAID SUBSYSTEMS



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- 2 Channel RAID LVD U2W Controller
- 10 Hot-Swappable Drive Bays
- Redundant Power Supplies
- 16MB Cache
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 - Power Supply Status
 - Cooling Fan Status
 - Visual and Audible Alarm

Q (3) 36GB 10,000RPM LVD HD 10,200
Q (3) 18GB 10,000RPM 5.0ms LVD HD 7928
Q (3) 9GB 10,000RPM 5.0ms LVD HD 6458

STC 20 BAY

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- Q (2) 4 Channel RAID 5 U2W Controllers
- 8 230 Watt Hot Redundant Power Supplies
- 128MB of Cache
- Internal Temperature Status
 - Power Supply Status
 - Cooling Fan Status
 - Visual and Audible Alarm

72GB Solution
Q (8) 9 1GB 7200RPM LVD HD 18,750
72GB Solution
Q (8) 9GB 10,000RPM 15.0ms LVD HD 20,300
144GB Solution
Q (8) 9GB 10,000RPM LVD HD 24,498



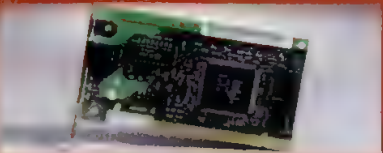
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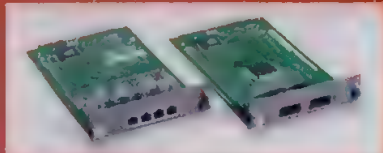
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RICK SHELLEY
via the Internet

I'M NOT DEAD YET

Bill Machrone may be right about film being dead for the movies ("Film's Dead, Are Actors Next?", September 1) but he is undoubtedly wrong in stating that "consumer film photography is only a couple of product cycles away from obsolescence." When standard 35-mm color film has the equivalent of 30 megapixels or more, and the best digital cameras get only 2 megapixels, we still have a long way to go. The digital cameras available today haven't even established a standard storage format! It will be at least ten years, if ever, before consumer digital cameras catch up with currently available film cameras in detail and color reproduction. And remember, the film manufacturers are improving their products all the time.

JIM GINGRICH
via the Internet

YEAR TO PANIC

Kudos to Jim Seymour for an enlightening article on Y2K ("Y2K and Your Family," September 1). The biggest problem for Y2K may be not the computers but ourselves. We may end up creating a problem far worse than a computer glitch with our panic and hype. It is my hope that the public and especially the media will take the same common-sense approach as Seymour has.

His opinion won't sell many \$24.95 survival kits, but considering that his advice is free as well as practical, I would encourage everyone to consider it.

As a banker, I am very familiar with the Y2K issue. The banking industry has worked tirelessly to get our Y2K house in order. Thorough testing of all mission-critical items gives every indication of Y2K compliance. It's very simple: There is no safer place for your money than a Federal Insured Depository Institution. For more information on Y2K and the banking industry, I urge you to visit www.fdic.gov.

DOUG BOHEMAN
via the Internet

SHARE AND SHARE ALIKE

With regard to your article in the Solutions section called "Share a Net Connection" (September 1), sharing an Internet connection doesn't resolve my problem any more than having a modem in each computer does. Please consider this situation: Computers A and B are networked—with or without a shared Internet modem connection—and the user has one e-mail address. Computer A calls

Corrections and Amplifications

In our First Looks article "The Closest Yet to Film" (September 1, page 56), we referred to the Ricoh and Sony cameras by the wrong product names in a few instances. The correct product names are the Ricoh RDC-5000 and the Sony Cyber-shot DSC-F55. In the summary of features table, the lens spec for the Ricoh RDC-5000 should have been f2.8. And the correct toll-free number for Ricoh is 888-742-8410.

up the e-mail and downloads all the new e-mail messages to the designated e-mail directory on its hard disk. computer B now calls up e-mail and has no access to the messages just downloaded by computer A.

There has to be some way to share the e-mail files as well as the modem. The browser would need a button that lets the user choose alternate e-mail directories and synchronize the e-mail directories on two or more computers. But sharing e-mail requires editing the Registry, and messages get eradicated when the host computer is down and the client computer connects to its default e-mail file. Is there any shareware out there that helps resolve this problem, or could your computer experts discuss a solution to this problem short of each computer having its own e-mail address?

GENTRY WADE
via the Internet

Microsoft's Internet Connection Sharing, as well as other third-party solutions for sharing a Net connection, assumes that each user on the network has a separate e-mail address. After all, what's important is that the users are networked, not the computers themselves. But if you're working with two networked computers and only one user between them, then the scenario changes completely.

The easiest way to have e-mail messages downloaded to two computers is to set the mail program on at least one of the computers to leave the messages on the mail server. If computer A is set up to do this, you can download e-mail to computer A, and the messages will still be preserved on the server from which computer A has downloaded. Then when you move to computer B and download e-mail, you'll get the same messages. All e-mail programs will let you leave messages on the server.

This doesn't, however, synchronize the messages: If you download to computer A, delete some messages, and save others in specific folders, computer B won't reproduce this organizing. To synchronize, for all intents and purposes, you need the same e-mail program on both computers, but even then it's not easy. If you're running Outlook 98 or 2000, you could share computer A's e-mail directory—in Outlook with Win 98, it's a hidden directory inside your Windows directory (/Local Settings/Application Data/Microsoft/Outlook/Outlook.pst)—and then copy that file to the same directory on computer B each time you use it. Or you could use the Import feature on

computer B to import that .PST file from computer A, after you have downloaded and organized the mail on computer A. If you do the latter, however, be sure to turn off the Leave Messages on Server option, or you'll end up both downloading the messages to your inbox and importing them from computer A.

We have yet to see shareware that handles sharing e-mail directories.—Ed.

MAKE A LIST

I note, with special interest, the feature of IE5 you mention ("IE5 Makes the Cut," Second Looks, July): links and images lists. I've used IE5 to print lists of links or the linked pages themselves, but I can't find any reference to images lists. I have a particular interest in preparing a list of images that appear on a page. Can IE5 do that? How would I find this capability?

STEVE LIVERS
via the Internet

You can display a list of images by downloading Web Accessories for Internet Explorer, available at Microsoft's Web site (www.microsoft.com/windows/ie/webaccess/default.asp). They're free, but Microsoft is releasing these without support. Once they're installed, you just have to right-click on any page and choose Images List to see a complete list of images on that page.—Ed.

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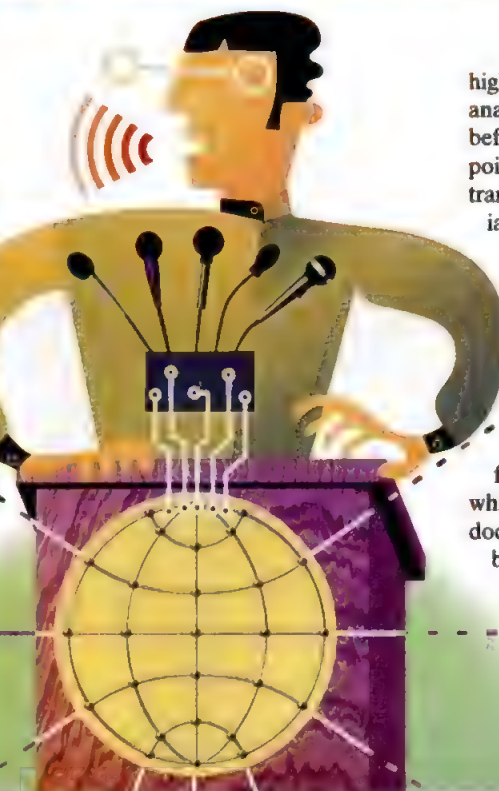
The worlds of voice-based and Internet-based communications are merging rapidly, with a cottage industry of

new voice applications taking shape. In addition to the Voice over IP (VoIP) efforts that giant technology and telecommunications companies have in place, start-up companies are embracing Internet telephony and voice applications. According to market researchers at RHK, Internet traffic will account for 93 percent of the volume on public networks by 2002, with voice traffic figuring prominently.

Like nearly all of the large networking companies, Cisco Systems recently debuted a far-reaching Internet telephony initiative. The company will link all of its local-area and wide-area network VoIP products to each other by this fall, and has already introduced a new router with built-in voice features. The goal is to encourage corporations to merge voice and data networks based on IP lines.

A partnership of Microsoft, Intel, Hewlett-Packard, and several other companies is working to produce new-generation telephony servers by the end of the year, and several other PC industry companies are working furiously to integrate voice and telephony with enterprise product offerings.

Companies grounded in telephony—from Nortel Networks to Sprint Communications—are also waking up to the call of integrating voice and Internet traffic, which is resulting in some compelling applications. Net2Phone, a subsidiary of telephony company IDT, has been grabbing headlines recently with its software that lets you place inexpensive calls from your PC to any phone. A U.S. domestic call placed through Net2Phone costs under five cents a minute at any time of day. The company also offers software, called Click2Talk, that lets PC-based callers talk directly to customer service representatives on



commercial Web sites; Net2Phone has also introduced fax services.

In addition, Net2Phone has deals with many commercial Web sites (including ZDNet) to provide online voice communications. At many sites, such as Excite and InfoSpace, voice-based community message boards are being implemented along with text-based boards.

At the recent Digital Living Room conference, Excite demonstrated a message board dedicated to cars. Participants on the board communicated via voice rather than text.

RocketTalk, ThinkLink, and other players are offering PC-based, long-distance service at rates competitive with those of Net2Phone. Although the ultimate goal for universal messaging services such as Onebox.com is to aggregate messages of different types—including e-mail, faxes, and voice mail—in one place, upcoming voice applications are looming in the future for all universal-messaging services.

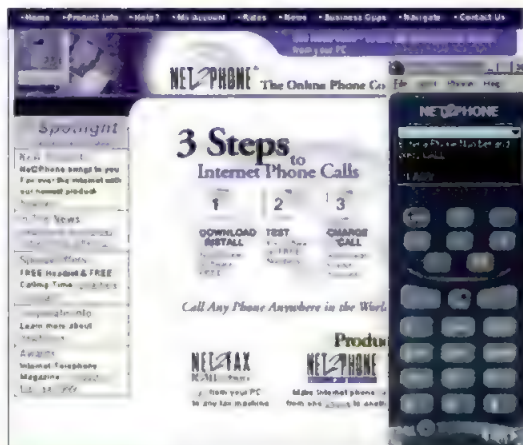
One of the major milestones in integrating voice applications with Internet applications will be reliable,

highly accurate voice-to-text synthesis. Most analysts agree that it will take several years before voice recognition is perfected to the point where you can expect a computer to transcribe a phone message from an unfamiliar voice accurately. But developers are exploring some unusual implementations of the concept of picking up a telephone and producing text-based Internet information.

A New York company called MobileWord offers a subscription-based service that lets you place a phone call to a toll-free number. You can record a message, which MobileWord will convert to a text document that can be retrieved over a Web browser. Xact Telesolutions has a similar, low-tech but interesting solution to the challenge of translating voice communications into e-mail. The company's ibyphone service is a subscription-based program that lets you send e-mail from any telephone, at any time, via a live operator

who takes dictation.

Among many other challenges, issues of speech recognition, security, voice-quality, and regulation face those companies delivering voice over the Internet. But we are already seeing a fledgling industry focusing on new voice applications and a widespread effort by technology and telecommunications companies to integrate VoIP technologies with their product offerings. —Sebastian Rupley



POCKET CHANGE: Net2Phone lets you place long-distance telephone calls over the Internet for less than five cents per minute.



Rewritable CD Drives Go Mobile

Could the next floppy disk be a rewritable CD-ROM? One of the final pieces of the puzzle drops into place this fall with the availability of CD-RW drives for notebook computers. CD-RW is already popular on desktop PCs, but until now the drives have been too bulky to fit into portables. The notebook CD-RW devices will be just half an inch high, so they'll fit inside virtually any portable. They'll weigh about 10 ounces and add \$200 to \$300 to a system's price tag.

CD-RW drives read standard data and audio CDs; write \$1 one-time-recordable CD-R disks, which can be played in computers and most audio CD players; and (here's how they could replace floppy disks) read, write, and rewrite \$10 CD-RW disks, which can be played in almost any current data CD, CD-R, or CD-RW drive.

MKE, Philips, and Sony are among the drive makers expected to have the lion's share of the early business. Gateway was the first notebook vendor to announce that it would offer CD-RW as an option. The company says its price for CD-RW will be \$200 in place of DVD and \$300 in place of CD-ROM. Compaq, Dell, and IBM are also expected to announce CD-RW plans by



year's end.

In fact, virtually every notebook maker will announce CD-RW as an option sooner or later, but volume delivery may be a different matter. The Japanese domestic market is taking a big chunk of current production, and it may not be until mid-2000 before supply and demand approach equilibrium.

While CD-RW disks are designed to be read by other CD drives, they can't be read by older CD drives and some DVD drives. Limitations aside, CD-RW could spur the further adoption of two-drive notebooks and still give road warriors—without requiring floppy disks or lengthy file uploads—reliable methods of file backup and person-to-person large-file exchange.—*Bill Howard*

INSIDE PC LABS

Test Your Own Printer



How does PC Magazine Labs test printers? Soon, you'll be able to see for yourself. For an evaluation appearing in our next issue (November 2), we

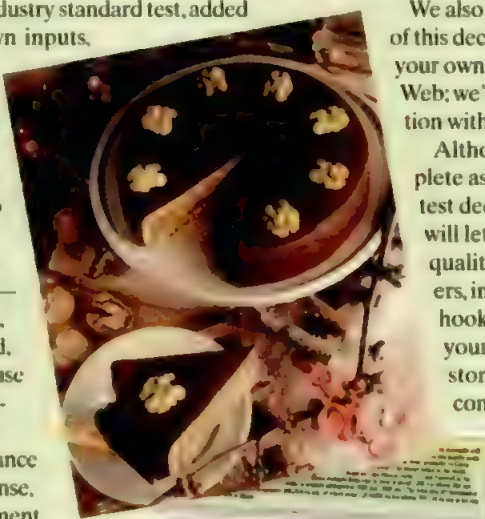
four types of targets—plain text, formatted text, text and graphics, and pure graphics. This lets us determine which printers are best for the kind of output you generate.

took a printer-industry standard test, added a few of our own inputs, and created a test-your-own strategy that puts some of our printer test programs into your hands.

Many printer-industry leaders—including Canon, Hewlett-Packard, and Lexmark—use Genoa Technologies' automated printer-performance test tool, PageSense, in their development labs. With that kind of industry acceptance, we decided to use Genoa's performance test tool in PC Magazine Labs to get accurate, consistent results. Genoa recently merged with another company to become QualityLogic. You can find it on the Internet at www.qualitylogic.com.

In addition to speed tests, the other important component of printer testing is the set of targets used in printing the results. Genoa developed an extensive test deck with help from many of the major players in the printer industry. This deck is updated annually to stay current with the latest printing technology. For this year's test deck, PC Magazine Labs worked with Genoa to include some of our standard test targets with Genoa's images.

But printer performance isn't about speed alone or quality alone. Many vendors cite high speeds for plain-text pages with only 5 percent text coverage, but they show quality output that may have taken more than 10 minutes per page to run. To prevent confusion, we decided to test printers in PC Magazine Labs with



We also developed a subset of this deck to let you test your own printer over the Web; we'll post it in conjunction with our next issue.

Although not as complete as the PC Magazine test deck, this subset deck will let you run output quality tests on any printers, including those hooked up to PCs at your local computer store. You'll be able to compare effectively

output quality and (with a stopwatch) even the relative performance of printers on display in stores.

While most printer vendors cite the optimal engine speed—that of a page with light text coverage measured midway through the test deck—we decided to implement a full, "click-to-clunk" test. That means we measured the entire time needed to spool up the printer, get all the data, and get all the



WHICH PRINTER TAKES THE CAKE? We tested printer performance with four types of targets—graphics (top), formatted text and graphics (below), formatted text, and plain text. This lets us determine which printers are best for the kind of output you generate.

pages through the whole printer mechanism. Because that's how our readers use printers, that's how we're testing.

This year, our printer testing will also include ink run-down tests so you can see how printers compare both in number of pages per ink cartridge and in cost per page. We'll post those tests on our Web site for your use as well, but because draining ink cartridges is a time-consuming process, we're not suggesting you do this frequently.—*Sieve Buehler*

WIRELESS NETWORKING

The Untethered LAN

Wireless LAN access has been a fragmented world, full of proprietary solutions and expensive products. Recently, several industry titans announced a far-reaching plan to change that, through a partnership to promote the adoption and standardization of IEEE 802.11 High-Rate (HR) Direct-Sequence (DS) wireless LAN access. The partnership is called the Wireless Ethernet Compatibility Alliance (WECA) and was founded by six companies: 3Com, Aironet, Intersil, Lucent, Nokia, and Symbol Technologies.

Apple has helped the push toward IEEE 802.11 wireless access by introducing its low-cost Airport technology. Apple iBook notebook users can pay just under \$400 for a base station and card, which enable them to access the Internet wirelessly. Similar technologies

are priced around \$1,000.

Products built to the new standard will use the 2.4-GHz radio band and run at 11-Mbps speeds. Interoperability, through certification of products from different manufacturers, will be a primary goal for WECA. Thus, an office user could take home a wireless-enabled notebook computer and seamlessly connect to a home network, regardless of the products powering the home and office networks. "WECA serves as a catalyst for the widespread standardization and deployment of IEEE 802.11 HR wireless LAN products," says Phil Belanger, WECA chairman.

WECA's objectives are to streamline the



technology and reduce the cost of IEEE 802.11 wireless Ethernet so that the proprietary solutions can give way to a common standard. The group also plans to create an independent test lab to certify wireless LAN products.

"The adoption of this standard is crucial for the mass deployment of wireless LAN technologies," says Bob Egan, research director at the Gartner Group.

Market researchers at Frost and Sullivan forecast that manufacturers' revenues

in the worldwide wireless LAN industry will approach \$884 million by 2002, which would represent a total growth of 113 percent over forecast 1999 revenues. In recent months, 3Com, Acer, Apple, Compaq, IBM, Lucent, and many other companies have announced wireless LAN solutions.—*Sebastian Rupley*

Finally, Some Reality Comes to Computer Games



Jake Kirchner

Maybe I have a genetic aversion to 2-D "reality," but somehow, despite almost 20 years of experience in personal computing, I've never developed much interest in computer games. Even with what pass for advances in today's 3-D technologies, the great bulk of these games are still so phony, so unreal, as to be laughable. But perhaps that's finally changing.

I say "perhaps" because on the graphics front, most computer games are still really lame. Gaming enthusiasts are so aware of the technical difficulties of generating lifelike 3-D images on a flat computer display that they are overwhelmed by every minor improvement in the graphics. Nongamers see these advances as merely more proof of how far we have to go, not—as gamers see them—as signs of how far we've come. Really, most computer games today are just flat images sliding around on a small piece of glass beyond your keyboard or game controller, typically augmented by psycho-acoustically enhanced, but still poor-quality, "surround" sound.

Those graphics and audio technologies will continue to advance rapidly, but the most welcome addition to computer gaming is a range of new immersive approaches that put you in the game, not just in front of it.

One excellent example is the *spherical video* created by new software from Enroute (www.enroute.com), which stitches together multiple images to create a panoramic, 360-degree environment, and provides a virtual-reality headset to put you in the middle of a real video. You merely glance left or right, up or down, to see a different portion of the 3-D world you're in.

The technology, shown to us at a recent *PC Magazine* Editors' Day in San Jose, has obvious potential for Web-based walkthroughs of houses for sale. But I like to imagine its application with a cool car-racing game, like Electronic Arts' Sports Car GT, the Editors' Choice in our August issue, coupled with one of the newest force-feedback racing wheel/pedal devices from Interact, Logitech, Microsoft, or Saitek (see our September 1 issue).

With this panoply of equipment, instead of watching a car speed by you on the monitor in front of you, you'd hear it approaching from behind and turn your head to see it gain on you and then whip by. You could really check your rear-view mirror for trailing vehicles or search skyward for approaching star destroyers, all by a quick eye or head movement.

Another fun, put-you-in-the-action technology we saw was from Reality Fusion (www.realityfusion.com). The company's software, when combined with an inexpensive digital video camera, can drop your on-camera, full-motion image right into your computer monitor. You play the games—BounceIt, PopTheBubbles, and Shoop—by standing in front of the computer and camera and moving your body as you watch your image on the screen reach out to touch icons, bat basketballs, punch karate opponents, and manipulate all sorts of objects. Your movements will look to outsiders like some sort of drug-induced, frenetic tai chi, but you'll soon get the hang of using your body as a full-contact input device.

Both companies, and their competitors in this race to make computer games real, like to tout the practical, business-oriented applications of their technologies. All well and good, I suppose, but after 20 years of waiting for the PC to become a decent entertainment device, I'm thinking the game's the thing.

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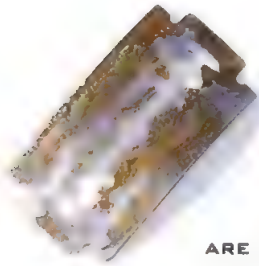
Says drugstore.com CIO Kal Raman, "One of the big advantages of working with Compaq is the support we get. They replaced Sun platforms with a seamless integration of Compaq ProLiant running Windows NT® and AlphaServer systems running Tru64 UNIX® in record time."

Left to right: Compaq AlphaServer, Compaq ProLiant, Compaq NonStop Himalaya



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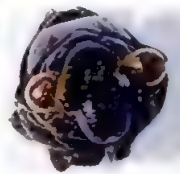
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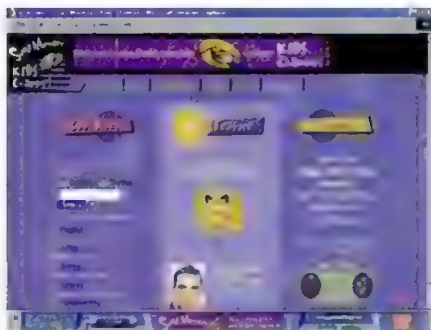
THEIR SHOT AT YOU.



INTERNET

Keeping Kids Safe Online

Kids are hanging out on the Internet as never before. In 1998, 8.6 million children and 8.4 million teens were online. By 2002, 21.9 million kids and 16.6 million teens will be online, projects market research firm Jupiter Communications. It also predicts that teens will spend \$1.2 billion and children will spend \$100 million online in 2002. Eyeing that lucrative demographic profile, companies



FOLLOW THE MONKEY: The SurfMonkey filter appears along the bottom of the browser.

are eager to show parents that their sites are kid-safe for shopping and surfing.

Among the latest approaches to filtering out inappropriate content is This.com, a full-service ISP designed to provide safe, family-friendly online service for \$21.95 per month. The company uses server-based recognition software to filter out unsuitable content, whether pornographic or hate-related. This.com is able to distinguish flesh tones, keywords, and expressions, and determine whether a given combination of the three is appropriate. Thus the ISP wouldn't block an art site with pictures of nudes, but would block a pornographic site.

If you don't want to switch ISPs but still want to find a safe jumping-off point for your kids to use the Internet, check out SurfMonkey.com. A kids' portal that offers free filtering software, SurfMonkey promises to block inappropriate content for kids as well as inappropriate communications with strangers online. The original version of the SurfMonkey filtering software was a separate browser that required a 14MB download. The latest version is a 250K browser plug-in that shows up as a bar at the bottom of your browser.

Activated by a simple password-controlled on/off switch, the plug-in bar accesses both a database of inappropriate sites and a filtering system that replaces any inappropriate text with asterisks. Kids can head to the Surf-

Monkey portal page, where the animated SurfMonkey character helps them navigate the Internet safely. The latest version of SurfMonkey is available for Microsoft Internet Explorer 4 and 5 now and is expected for Netscape and America Online by the end of the year.

One new player on the scene is Crayon Crawler, a free browser from 1st Net Technologies that lets kids visit only sites preselected by parents or sites listed in the compa-

ny's database of 1,600 education and entertainment sites. No random surfing is allowed. Additional features such as chat, a talking bookreader, and instant messaging are available for \$4.95 per month.

To help you sort through all the options available for protecting your kids online, you may want to seek a little outside advice. At the recently launched GetNetWise site (www.getnetwise.org), you'll find the Internet Safety Guide, which explains the potential safety risks of e-mail, chat rooms, and Web sites. The site also details technologies for monitoring Internet usage, filtering objectionable content, and controlling computer use.—Sharon Nash

DISPLAYS

LCD Panel Pricing Peaks

At the start of this year, manufacturers that use LCD panels in their products were singing the short-supply blues. Customer demand has been for larger panels with higher resolutions, but this effectively reduces the worldwide production capacity. A single piece of glass substrate produces fewer large panels than smaller ones.

This increased demand developed at the same time that many LCD producers were struggling with the effects of the Asian economic downturn. Many producers were already selling panels at little or no margin, and they didn't have the capital needed to build next-generation production lines capable of handling larger glass substrates, which could make panel manufacturing more efficient.

According to market-research firm Stanford Resources, the industry may have turned the corner on LCD panel prices, as new manufacturing facilities have come online sooner than some analysts expected. As a result, panel supplies should be able to match demand and competitive forces will help push prices down. The company bases its projections on data it collects on both the demand side in the U.S. and the supply side

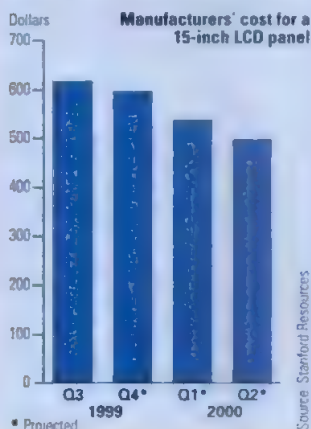
among Asian manufacturers.

Stanford Resources estimates that the average cost of a 15-inch XGA LCD panel peaked in August of this year at \$620, and the company projects that the average cost will slide to \$600 by the fourth quarter. Further drops are projected for next year, with a first-quarter average cost of \$540, which will then fall below \$500 in the second quarter. (These figures are for the bare panels that manufacturers sell to display makers.)

Despite these price drops, desktop LCD monitors still face an uphill battle in pushing traditional CRT monitors off the business desktops in the U.S. Stanford Resources estimates that the average price of a 17-inch CRT monitor (roughly equivalent in viewing area to a 15-inch LCD panel) was just \$334 for the second quarter of 1999; 19-inch models averaged \$535 in the same period. Even without additional price reductions—which are expected—these monitors cost less than the bare LCD panels. LCD monitors will continue to cost at least three times as much as equivalent CRTs—a price differential that's difficult to justify in typical business applications.—Alfred Poor

More Affordable

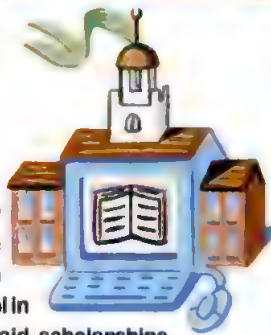
As new production capacity is coming online quickly in response to increased demand, the cost of building flat panels is dropping. The lower prices will affect all products that use flat panels, including desktop monitors and notebooks. But flat panels remain expensive compared with CRTs. The consumer street price of an LCD built around a \$620 panel is about \$1,000.



College Prep

By Michael E. Ryan

At this time of the year, high-school seniors and their parents are starting to get serious about the college application process. But finding the right college can be a difficult task. Not only do you have to track down a good school in a good location, but you may also have to worry about financial aid, scholarships, and application procedures. Fortunately, the Web is spilling over with information on all of these topics. The following sites provide a wealth of information on colleges and the college-entry process that may prove invaluable to any aspiring student.



Find a School

► The first and most important step in the college-entry process is finding a school that suits you. No matter how you want to select a school, **embark.com** (www.embark.com) should prove extremely helpful. This exhaustive site is an all-in-one online resource if you're interested in an undergraduate, graduate, MBA, or law degree. The site's MatchMaker feature lets you find a school based on criteria such as location, major, tuition, religious affiliation, varsity athletics, and many other variables. Once you find a school you like, you can research the financial aid options available.

For more college search options, surf to **The Princeton Review Online** (www.review.com). Like **embark.com**, this site lets you search for undergraduate, graduate, and post-graduate programs. It provides some helpful tips on beating the admissions tests required for each program. The site also offers useful advice on school selection and financial aid, and you can see how well your favorite schools fared in the Princeton Review's "Best 331 Colleges."

Apply Yourself

► Getting all your information straight is one thing, but filling out one of those lengthy college application booklets is another. Fortunately, many schools are beginning to accept online applications for admission. Both **embark.com** and **The Princeton Review Online** let you apply to schools

online. In addition, **CollegeXpress** (www.collegexpress.com) offers a long list of schools to which you can apply online. The site also offers a good college search engine and plenty of information on financial aid and college athletics.



embark.com's MatchMaker finds colleges based on location, admission requirements, enrollment, and other criteria.

The **GoCollege** site (www.gocollege.com) is another good online resource for applying to schools. Using links to college Web sites, GoCollege makes the application process easy and intuitive. The site offers plenty of information about finding the right college, getting financial aid, and earning higher scores on exams like the SATs and ACTs.

Tackle Tuition

► Once you've picked out your future alma mater and you've been accepted, you'll need to come up with some way to pay your tuition and other school expenses. **FinAid!** (www.finaid.org) can help. This useful site explains the different types of financial aid available and offers some warnings about potential scholarship scams. A number of financial aid calculators let you project your four-year tuition total, financial needs, and future loan payments.

A partner of **FinAid!**, **fastWEB.com** (www.fastweb.com) launched in 1995 as a scholarship database and search tool. Today, **fastWEB.com** offers a college search feature, cost calculators, career-planning guides, and links to online textbook stores. Scholarship information is still the main focus of this site, however, and with over 400,000 scholarships to research in its database, you simply can't beat **fastWEB.com** in this department.

Hit the Books

► One of the hidden costs of college is the enormous amount of money you'll need to spend on textbooks every semester. These sites won't alleviate the costs of the books very much, but they can help you avoid long lines at the bookstore and a sore back from carrying all those hardbound volumes back to the dorm. **efollett.com** (www.efollett.com) is the Amazon.com of college textbooks. Here you'll find an extensive collection of new and used books matching the course requirements of nearly 600 colleges and universities throughout the country. If

efollett.com doesn't have your book in stock, chances are you don't need it for your classes.

Another site to keep your eyes on is **eCampus.com** (www.ecampus.com). The site's humorous TV commercials, which promise to make you less broke, will probably attract many people, but the site itself should be made less broken, as it wasn't working very well when we looked at it. When it is working, however, **eCampus.com** offers an impressive catalog of textbooks and college merchandise at discounted prices, as well as an online auction service that may help you unload your old books and find a few bargains. **PC**

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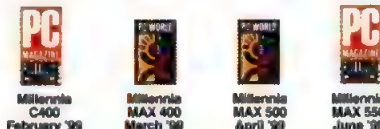
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Hand Combat

The Handspring Visor takes on the Palm organizer by adding a special slot for plug-and-play hardware and software upgrades.

By Bruce and Marge Brown

And now for something completely the same. Well, not quite. Brought to you by the same people who thought up the 3Com PalmPilot, the Handspring Visor is a new PDA that looks similar to the Palm organizers and runs the same operating system and applications. But the Visor differs from Palm devices in several important respects—most notably in its innovative expansion options and lower price tag.

For this story, we tested the Handspring Visor Deluxe (\$250 street), which includes 8MB of system memory. A 2MB model is also available for \$180 street. Later this year,

Handspring plans to release a third model, the 2MB Visor Solo (\$150 street), which has no docking cradle.

The guts of the Visor Deluxe model bear a striking resemblance to Palm organizers. The Visor Deluxe is based on the same 16-MHz Motorola Dragonball EZ processor running Palm OS 3.1. Like Palm devices, the Visor unit includes an infrared port for beaming with other Palm OS organizers; the same, improved reverse-backlit LCD touch screen used on the latest Palm models; and a docking cradle

(the Visor has a USB connector; Palm devices have serial cables). The Visor also includes a microphone but has no speakers or headphone jack.

The most obvious difference is the expansion slot on the back of the Visor. Called the Springboard, this plug-and-play slot lets you quickly add extras such as pagers, modems, MP3 players, Internet access programs, and all types of applications and utilities. To vault Springboard into the mainstream market, Handspring plans to license Springboard technology to other computer manufacturers and encourage third-party development of expansion modules.

Throw in the unit's built-in applications, five color choices,

PLUG-AND-PLAY: The Springboard slot makes it easy to enhance the Visor.



ALL TALK, NO TYPE:

IBM and Dragon Systems improve their voice recognition offerings. *Page 44.*



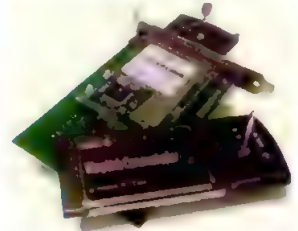
STREET SMARTS:

We take a test drive of the feature-rich Clarion AutoPC. *Page 56.*



WARP SPEED:

The Acer WarpLink Wireless Network makes home networking simple and affordable. *Page 73.*



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and compatibility with the wide array of Palm applications already out there, and you have a PDA that is poised to give Palm organizers a run for their money and perhaps to broaden the use of hand-held devices at work and at home.

Basic Stats

Even with its back panel expansion slot, the Handspring Visor Deluxe is slim, measuring 4.8 by 3.0 by 0.6 inches (HWD), and quite comfortable to hold at 6 ounces with batteries. A removable, hard plastic screen cover is included. The device runs on two triple-A alkaline batteries (included) with a rated battery life of two months. Controls consist of four customizable application launch buttons, two scroll keys, and power/backlight button.

Although the Visor's monochrome screen, with its 2.1- by 2.1-inch viewable area, can't match the color screens on Microsoft Windows CE-based palm-size PCs (P/PCs), its reverse backlit display provides good visibility in both well-lit and dark locations; the Visor also comes with a choice of three fonts. A small icon to access the contrast adjustment is conveniently located in the lower left corner of the

input area. In addition to Palm OS 3.1-compatible third-party input applications, there are three standard means of entering information: Graffiti characters, the Visor Deluxe virtual keyboard, and a host PC's keyboard (for synchronized files).

Software for the unit includes a CD with the Palm Desktop application and User Guide. Its PIM includes familiar Palm organizer applications: Date Book (6,000 appointments), Address Book (12,000 contacts), To Do List (6,000 items), Memo Pad (6,000 memos), Expense, Mail (400 messages), Security, and HotSync.

Handspring has improved on some of the Palm applications. The Calculator now supports advanced scientific and business operations. The Date Book+ includes integrated To Do List items, new views, unscheduled events that float until completed, and event templates. Handspring also includes a handy World Clock.

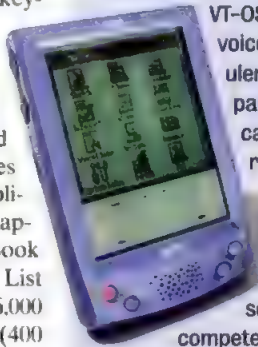
You can synchronize your appointments and contacts on the Visor with Palm Desktop and Microsoft Outlook data via HotSync. You can't directly receive and send e-mail with the device, but you can read, create,

Low-Priced PDA

The 4MB VTech Hello PDA (\$199 direct), from VTech Information, is a low-cost, consumer-oriented hand-held computer with a proprietary operating system, the VT-OS 1.1. Its installed applications include a voice recorder, phone book, to-do list, scheduler, memo function, e-mail manager, sketch pad, expense manager, calculator, Communication Intelligence Corp.'s Jot handwriting recognizer, and a program for synchronization with contact managers.

Running on a 32-bit RISC 75-MHz processor, the Hello delivers decent performance and legibility on its 16-level grayscale, backlit screen. The VTech Hello PDA is a competent device, but it faces an uphill challenge.

VTech Hello PDA. VTech Information, Campbell, CA; 877-883-2446; www.myhello.com.



delete, and forward e-mail on your PDA and then HotSync with your desktop e-mail program.

Room for Expansion

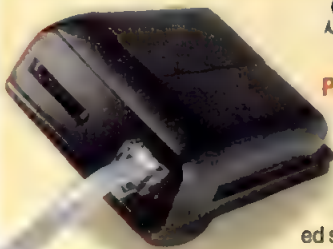
Concealed by a removable protection panel, the Springboard expansion slot resembles, but is slightly larger (2- by 2.1-inches HW) than, a CompactFlash card slot. Expansion modules slide snugly into the slot, so no protective door is required.

Most Visor Deluxe users won't have to worry about memory expansion, because

typical Springboard module applications will run in the expansion module's memory rather than in the PDA's system memory. Some modules will accommodate additional memory via integrated SmartMedia expansion slots.

The generically named Handspring Backup Module (\$40 direct), provides portable backup storage for all Visor models. Handspring and other companies are developing Springboard expansion modules (see the sidebar), which include modems, digital cameras,

Slotted for the Handspring Visor



Point of Contact

Handspring will deliver a Springboard expansion slot modem, the Handspring Modem Module (\$130 estimated street), by year-end. The 33.6-Kbps wireless modem includes an RJ-11 jack and USB port on its top panel

for connection to either a phone line or a computer with a USB port. Connectivity is established by pressing the HotSync button on the module itself or using the HotSync command on the Visor screen. You'll need additional third-party software for modem-enabled tasks such as faxing, processing e-mail, and accessing the Internet. **Handspring Inc.**, Mountain View, CA; 650-586-8100; www.handspring.com.

PDA Player

Visor owners can record voice messages and listen to MP3 music files or spoken audio content with the InnoGear MiniJam Springboard expansion module, which is planned for late '99. MiniJam includes a speaker, headphone jack, headphone, DC-IN power jack, and both Visor and desktop file management applications. It runs off the Visor batteries; AC adapter accessories are planned. Two modules will be available—one with 64MB of internal memory and a SmartMedia slot for external memory expansion and a lower-priced model with no internal memory and a SmartMedia slot. **InnoGear**, Gilroy, CA; 408-848-8338; www.innogear.com.



GPS receivers, pagers, bar code scanners, audio players, portable keyboards, voice recorders, travel guides, games, and reference, productivity, and utility software.

Although most modules are still under development, we were able to test the Springboard using EA Sports' Tiger Woods PGA Tour Golf (\$30 direct). The plug-and-play capabilities of the Springboard worked flawlessly. Upon inserting the module, the game's main menu immediately popped up on the screen. When you've completed your round, you can simply remove the module and the Visor will resume whatever it was doing previously.

You can also download software using HotSync and the Palm Install Tool computer program. For example, the identical Tiger Woods game is available on CD-ROM (\$30 direct). The clear advantage of buying the game on a Springboard module is that installation is quick and easy.

A microphone is standard, but the Visor Deluxe unit has neither a speaker nor jacks for headphones or earphones, because a program requiring such features, such as an MP3 player, installs with all necessary software and hardware upgrades

Visor vs. the Competition

	Handspring Visor Deluxe	3Com Palm IIIx	Casio Cassiopeia E-100
Street price	\$250	\$370	\$500
CPU/Speed	Motorola Dragonball EZ / 16 MHz	Motorola Dragonball EZ / 16 MHz	NEC VR4121 / 131 MHz
Memory (RAM/ROM)	8MB / 2MB	4MB / 2MB	16MB / 16MB
Expansion options	Springboard expansion modules	Expansion accessories for internal expansion slot	Type II CompactFlash cards
Size (HWD, in inches)	4.6 x 3.0 x 0.8	4.7 x 3.2 x 0.7	5.1 x 3.3 x 0.8
Weight with batteries	6 ounces	7 ounces	9 ounces
Operating system	Palm OS 3.1	Palm OS 3.1	Microsoft Windows CE 2.11
Viewable screen size (HW, in inches)	2.1 by 2.1	2.4 by 2.4	3.1 by 2.4
Screen technology	Passive matrix	Passive matrix	Active-matrix TFT
Color depth	16-level gray scale	16-level gray scale	64K colors
Light levels	One brightness setting with variable contrast	One brightness setting with variable contrast	One brightness setting with variable contrast
Backlit	Yes	Yes	Yes
Battery type/Rated life	2 AAA / 2 months	2 AAA / 2 months	Lithium ion / 6-8 hours
Infrared port	Yes	Yes	Yes
Audio features	Microphone	None	Microphone, speaker, stereo earphone jack
Standard computer interface	USB port	Serial port	Serial port

imbedded in a single Springboard expansion module. This approach is a big departure from other PDAs, which tend to have more limited expansion and upgrade options that are more difficult to install.

Other Extras

The Visor Deluxe is available in five colors: graphite, green, orange, blue, and ice, and it comes with a leather slip case. Docking cradles in granite or ice and a serial port synchronization cable are under development. Palm

organizer hardware accessories are not compatible with HandSpring PDAs.

Aside from its Springboard module, the Visor breaks little new technical ground for PDAs. In many respects, the Windows CE-based P/PCs retain the technical edge—with greater memory capacity, color screens, and more built-in hardware and software.

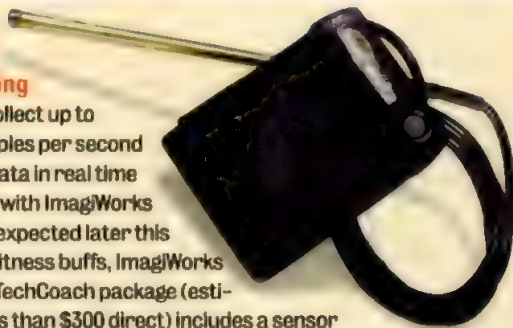
But the Visor still has a lot to offer. First, Handspring has wisely chosen to build on the popular Palm OS and applica-

tions. Second, the Springboard makes it simple to augment the capabilities of the Visor. Finally, the price ensures that the Visor won't remain a power toy for CEOs only. All these factors should make the HandSpring Visor Deluxe an instant hit.

Handspring Visor Deluxe. Street price: \$250. Requires: 8MB RAM (16MB recommended); 25MB hard disk space; Microsoft Windows 95, 98 or NT. Handspring Inc., Mountain View, CA; 650-566-8100; www.handspring.com. **PC**

Sense of Well-Being

You can collect up to 1,000 samples per second and plot data in real time on a Visor with ImagiWorks modules, expected later this year. For fitness buffs, ImagiWorks Personal TechCoach package (estimated less than \$300 direct) includes a sensor expansion module, Visor application, heart monitor, and desktop software for measuring and analyzing heart rate through a wireless sensor connection. The SensorScience Starter Kit Temperature package (estimated less than \$180 direct) includes a sensor expansion module with analog and digital ports, Visor application, and temperature sensor. **ImagiWorks Inc.**, San Mateo, CA; 800-929-6767; www.imagiworks.com.



Beeper Board

The InfoMitt Pager Springboard module (\$50 direct), from InnoGear, also planned for late '99, adds a 900-MHz one-way alphanumeric pager to Visors. PageNow! from Mark/Space Software ships on the InfoMitt module for automatic installation. PageNow! supports one-way paging through the standard TAP protocol. Users will receive a unique toll-free number for incoming pages and an e-mail address for forwarding POP3 e-mail system messages to their Visor. Global Access is offering a 200-message SkyTel service network package for InfoMitt users (estimated at \$39.95 for three months). **InnoGear**, Gilroy, CA; 408-848-8338; www.innogear.com.



Hands-Off Computing

New versions of speech recognition programs deliver better accuracy and more features.

By Greg Alwang

Dragon Systems and IBM have updated their voice recognition offerings with larger vocabularies, better usability, and improved accuracy that will help ease the move to speech-enabling your applications. Dragon NaturallySpeaking Preferred Edition 4.0 (\$199 list) and IBM ViaVoice Pro Millennium Edition (\$179 list) each have revamped recognition engines, condensed training times, and enhanced vocabulary tools.

We tested both side by side on similar systems with surprisingly good results. NaturallySpeaking 4.0 has the last word because it is both accurate and easy to use, followed closely by Lernout & Hauspie's VoiceXpress 4.0 (First Looks, July 1999) and then ViaVoice.

Dragon NaturallySpeaking Preferred 4.0

Training and processing our language files took all of 7 minutes, and the 10-minute Quick Tour covered all the basics for using NaturallySpeaking 4.0. Our initial accuracy was a surprising 96.5 percent, and after only an hour of dictating and using the Vocabulary Builder, we were at a lofty 98 percent.

Improved accuracy comes from Dragon's 160,000-word active (memory-resident) vocabulary and its BestMatch language modeling, which enhances accuracy further on PCs faster than 300 MHz. NaturallySpeaking 4.0 supports a wider range of language models—including children, teens, and senior citizens, making the software ideal for families with several users of different ages. The enhanced Vocabulary Builder not only records new words but also updates your

language model regarding your specific writing style.

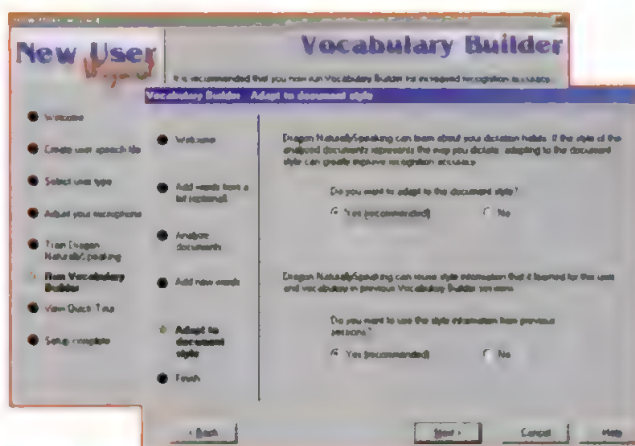
Dragon's NaturalWeb feature lets you browse by voice using Microsoft Internet Explorer. You can enter Web addresses, navigate through pages and links, select check boxes, and enter text into forms. Both NaturallySpeaking and ViaVoice also support new commands in Microsoft Office 2000.

NaturallySpeaking 4.0 is an intuitive and powerful speech tool, and it should prove a welcome addition to users looking to speech-enable their PCs.

Dragon NaturallySpeaking Preferred Edition 4.0. List price: \$199. Dragon Systems Inc., Newton, MA, 800-437-2466; www.dragonsystems.com.

IBM ViaVoice Pro Millennium Edition

A new, customizable VoiceCenter interface and a host of new wizards streamline complex tasks. The Recognition Wizard helps pinpoint recognition problems, and a Navigation Macro



SPEECH THERAPY: NaturallySpeaking's Vocabulary Builder can pick up new words and analyze documents to boost accuracy.

Creator lets you easily build voice macros.

ViaVoice encourages users to correct dictation using both the keyboard and voice, and in either case your language model is still updated (only voice corrections updated the language model in previous versions). To correct dictation by speech only can be difficult, which makes keyboard correction a welcome addition.

Training and language model processing took about 18 minutes on our Pentium II/300 test machine. On our tests, ViaVoice achieved 95.6 percent accuracy out of the box and after two

hours of use climbed to 97.7 percent.

As with Dragon NaturallySpeaking, there are several options for augmenting your dictation vocabularies. An Analyze Document option searches your documents for unknown words, and a Topic feature loads specialized topics such as Computers or Chatter Jargon, depending on the current application.

Simply say "surf the Web" and ViaVoice starts Microsoft Internet Explorer, Netscape Navigator, or AOL (whichever you use) and lets you browse by voice. When viewing Web pages, ViaVoice shows voice labels next to items, such as graphics links, that have no obvious voice commands. Simply say the number command next to a voice label to pick that option.

Though ViaVoice lacks a video for getting started, new users will appreciate the context-sensitive "What Can I Say" option, which shows voice commands specific to the program they're in. Although ViaVoice delivers solid results on accuracy tests, the program is not quite as intuitive when navigating and correcting as NaturallySpeaking or VoiceXpress.

IBM ViaVoice Pro Millennium Edition. List price: \$179. IBM Speech Systems, West Palm Beach, FL; 800-825-5263; www.software.ibm.com/speech.

E-mail by Phone

GenSoft's Mercury Mobile 1.0 (\$80 list) lets you hear and respond to e-mail simply by phoning your PC. You can call to get your mail or—if you prefer—it will call you at a specified number when important messages arrive. Mobile professionals who can't always connect to e-mail and don't want the overhead of another messaging service will appreciate Mercury Mobile's simplicity and cost.

The software works only with a TAPI-compliant voice modem or ISDN connection. We tested the product with a 3Com U.S. Robotics 56K Voice Winmodem; messages were fairly audible, depending on the quality of the connection. The text-to-speech engine lets you set the pitch, speed, and gender of the voice. Using the phone's touchpad, you can skip through messages and even send three canned e-mail replies—"Yes," "No," and "Got the message; will get back to you." It can even detect the language of messages and read them back in English, German, Spanish, Italian, or French.—Greg Alwang

Mercury Mobile 1.0. List price: \$80. GenSoft (published by CenturionSoft); Washington; 202-283-5151; www.mercurymobile.com.

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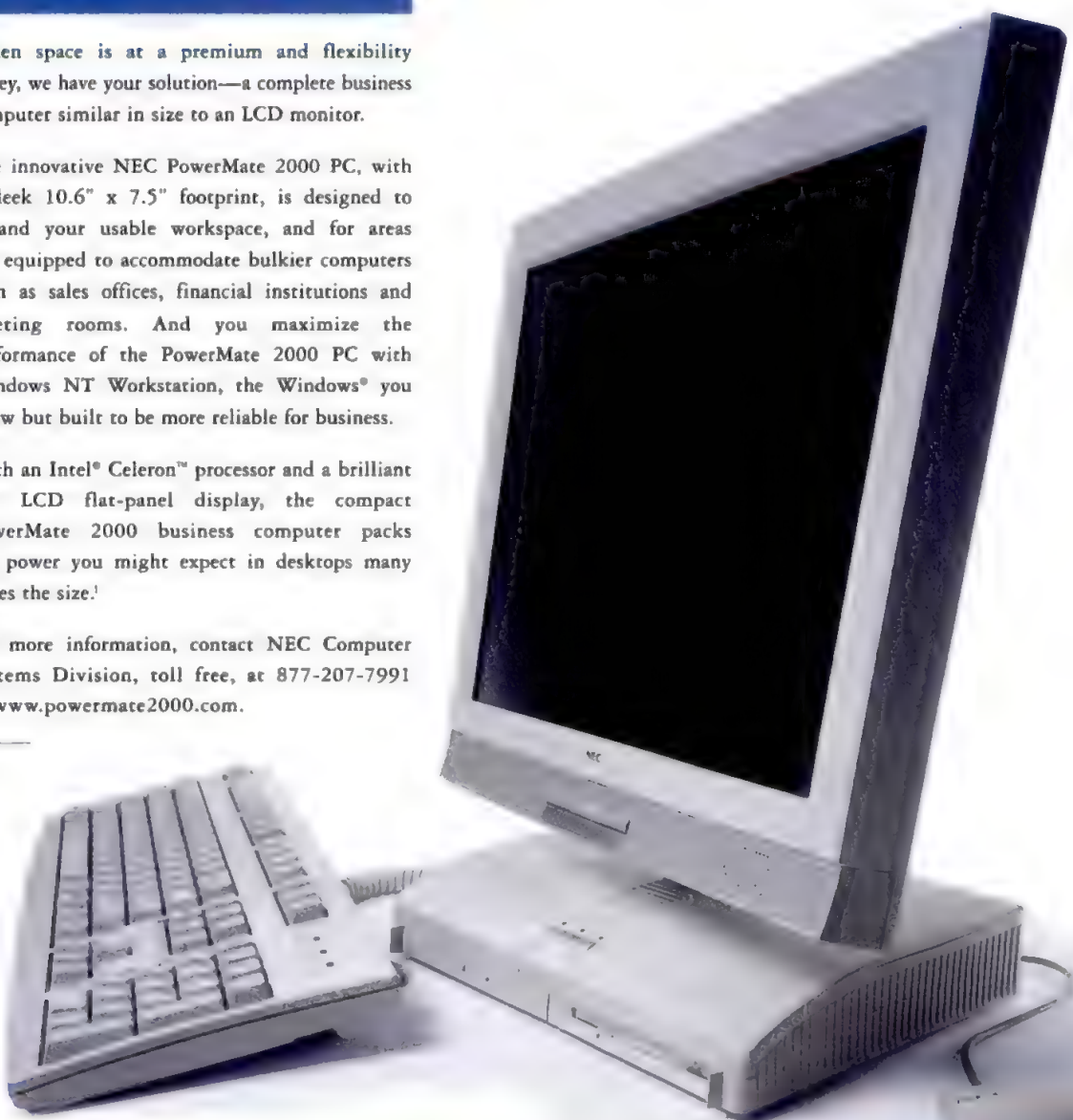
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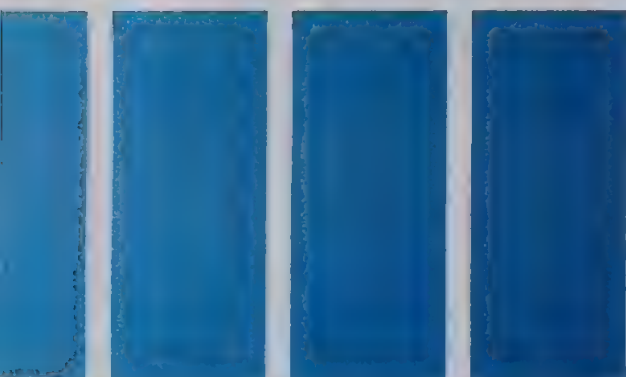
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Standard features include 64MB RAM, a 6.4GB hard drive, and floppy and CD-ROM drives. Ships pre-loaded with either Microsoft NT Workstation or Windows® 95. When referring to hard drive capacity, GB stands for one billion bytes. Some utilities may indicate varying hard drive capacities. Total user accessible capacity may vary depending on operating environments.

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Access Anywhere

Two new wireless CDPD IP modems work with both notebook PCs and Windows CE devices.

By Bruce Brown

Wireless Internet connectivity for PCs and PDAs is struggling toward toddlerhood. New products from two established players in the CDPD (Cellular Digital Packet Data) modem market take baby steps toward easing wireless access, particularly for those who use a variety of mobile devices.

The Novatel Wireless Merlin (\$280 street, plus carrier charges) and the Sierra Wireless AirCard 300 (\$549 list or \$599 with battery power pack, plus

carrier charges) are 1.6-ounce Type II PC Card CDPD modems that can work in notebook PCs running Windows 95, 98, or NT, or in Windows CE (Version 2.0 or later) H/PC or H/PC Pro (Jupiter) models.

CDPD throughput maxes out at 19.2 Kbps, with realistic performance rates closer to 14.4 Kbps and sometimes dropping lower. Though you might be used to broadband Internet access, it's currently unrealistic to expect the same level of performance with a wireless connection. When used for vital com-

munications, for intranet access, or by the very patient, however, CDPD can be a convenient way to sign on anytime in most metropolitan areas in the U.S.

Service-plan usage pricing varies, like cellular phone plans. Currently, CDPD wireless service from AT&T Wireless, Bell Atlantic Mobile, and GoAmerica ranges from low-usage plans, priced from \$10 to \$25 a month, to unlimited-access plans for the permanently wired, for \$55 to \$65 a month.

The Merlin, which is significantly less expensive than the AirCard 300, is a Type II PC Card with a permanently attached thin, 3-inch antenna that swivels in different directions. The antenna is attached to a half-inch protuberance that sticks out from the inserted PC Card. The antenna appears relatively rugged, but because it's permanently attached, you would be prudent to extract the Merlin when you pack your notebook or PDA in its case or in a bag for traveling.

The Merlin's installation CD runs different setup programs for PCs running Windows 95, 98, or NT and for Windows CE devices. Setup was uneventful and straightforward. After installation, you run the Wireless Management software to enter the IP address and other identification data that is supplied when you sign up for wireless IP service.

Sierra Wireless builds on its success with the AirCard 300 for Windows CE (reviewed in First Looks, February 9) with the AirCard 300 for multiple platforms. Like the platform-

PICK A CARD: The Merlin has an attached antenna; the AirCard 300's is removable.



specific Windows CE model, the AirCard 300 is a

Type II PC Card with a stubby, detachable, retractable antenna. Rather than pulling out the whole card for traveling, you can leave it in place and just pop off the antenna. This is convenient but perhaps more likely to end in component loss or misplacement.

As with the Merlin, separate programs are used to install the AirCard 300 on Windows PC and Windows CE platforms. Service configuration is also similar, once you have valid registration from a service provider.

In testing both in New York and in north central Connecticut, the Merlin and AirCard 300 performed approximately the same. It's relatively easy to find and hold a CDPD signal in Manhattan and relatively tough in northern Connecticut. Wireless IP access is a fine way to make a moderate-speed Internet connection if you live or work in areas with good service coverage.

The new Novatel Wireless and Sierra Wireless modem cards enable those with multiple mobile devices to use a single CDPD modem, and they let IS managers maintain and support a single unit for notebook and PDA users.

Novatel Wireless Merlin. Street price: \$280. Novatel Wireless Inc., San Diego, CA; 888-888-9231; www.novatelwireless.com.
Sierra Wireless AirCard 300. List price: \$549; with Power Pack, \$599. Sierra Wireless Inc., Richmond, BC, Canada; 604-231-1100; www.sierrawireless.com.

Build a Better Mouse...

The mouse has remained essentially unchanged for more than a decade, but now Microsoft has come up with a mouse more befitting our high-tech era. The IntelliMouse Explorer with IntelliEye (\$75 street) doesn't look or act like an ordinary input device. A warm red glow emanates from the bottom of its sculpted, graphite-colored housing. Under the hood, IntelliMouse Explorer employs an

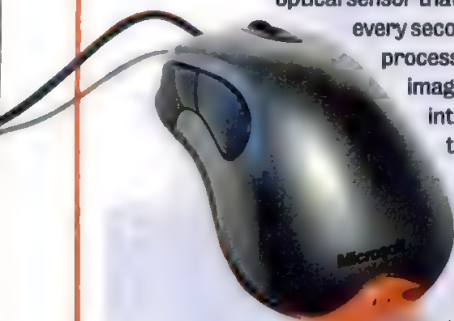
optical sensor that takes 1,500 snapshots every second and a digital signal processor that analyzes those images and translates them

into movement. Together, this technology is known as IntelliEye. Sounds cool, but why is this so useful? Because, since the IntelliMouse Explorer has no moving parts, it won't get sidelined by dirt, dust, or excessive wear. And

it works on virtually any surface without a mousepad.

In addition to the left and right buttons and scroll wheel, the IntelliMouse Explorer includes two buttons positioned where your thumb normally rests. By default, these side buttons are configured to go forward or back when browsing Web pages—a big convenience that, with the IntelliEye technology, offers significant advantages over your boring old mouse.—John Morris

Microsoft IntelliMouse Explorer. Street price: \$75. Requires: Microsoft Windows 95, 98, or NT 4.0; serial or USB port. Microsoft Corp., Redmond, WA; 425-882-8080; www.microsoft.com.



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AIM (a Little) Higher

An update to America Online's instant-messaging client delivers some modest enhancements.

By Jim Lynch

The instant-messaging (IM) wars continue to rage between Microsoft and AOL, with each side seeking to maximize whatever advantages it has by lining up allies and introducing new features as quickly as possible. Toward that end, AOL has released an update to its popular instant-messaging client, AOL Instant Messenger (AIM). Version 3.0 adds a news ticker, buddy icons, and an automatic log-on feature for times when users temporarily lose ISP connections.

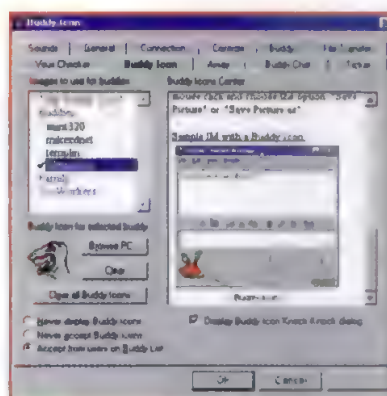
AIM now has the ability to display news headlines in a ticker window. Headlines can also be viewed in a window separate from the ticker, making the entire selection of headlines easier to see. You can choose from Top

News, Sports, Entertainment, and Business (a stock ticker is promised but was unavailable at this writing).

Don't expect much else from the ticker. Frankly, we found it more than a little ugly. The colors are fluorescent green on a black background and cannot be changed by the user.

Unfortunately for AOL, news headlines are nothing new to IM clients. Yahoo! Messenger, for example, has a much better way of doing things. You can easily see your My Yahoo! news right from the Messenger interface by clicking a tab, without having to open a browser window. And since all of this information is based on your My Yahoo! preferences, you can easily customize it whenever you want.

Buddy icons are another new



BUDDY SYSTEM: You can create your own buddy icons or use the links that AOL provides to download free icons.

feature in AIM 3.0. You can choose an icon to represent one of your buddies and have it displayed at the bottom of the IM window. This is a fun feature that's bound to be a hit with kids and teenagers.

AIM now contains an auto-log-on feature for when you get knocked off your ISP. Right after you lose your connection, a

small window will pop up informing you that AIM is trying to reconnect. If you're on dial-up access, AIM will redial your default connection (assuming you have that option set up in your Windows Internet Properties configuration).

In all, this is an incremental release for AOL. If you're already on AIM and need a news ticker, like cute icons, or want to avoid manually reconnecting

to your dial-up ISP, then Version 3.0 is worth downloading. But there isn't enough here to warrant switching to AIM from a different IM client.

AOL Instant Messenger 3.0. Price: Free download. Requires: 8MB RAM; 5MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. America Online Inc., Dulles, VA; www.aol.com.

Imaging Made Easy

Ulead PhotoImpact 5 is designed for quick workflow without sacrificing control or creativity.

By Sally Wiener Grotta & Daniel Grotta

Graphics enthusiasts and Web designers can create attractive graphics quickly with the latest release of Ulead's graphics editor. Although it takes a while to master, PhotoImpact 5 (\$79.95 street) is a feature-rich image-editing program that lets you work faster and more creatively.

PhotoImpact's interface reduces mouse clicks by bringing most popular tasks to the surface in floating palettes. The customizable EasyPalette, with its drag-and-drop preset edits, now has a more easily navigated hierarchical organization. Right mouse click menus have been extended, and the new Visual Open feature dis-

plays thumbnails of all images.

PhotoImpact makes creating graphical elements for your Web page a snap. The new Component Designer is a robust three-step wizard for creating banners, buttons, and other Web objects, using 1,000 fully customizable

templates. The new Java Roll-over Assistant creates the three states of a button from any three selected objects. PhotoImpact now supports image slicing, not only for the Web, but also in the scanner interface, permitting automated batch scanning of several snapshots on a flatbed into separate image files.

New drawing tools make designing buttons, arrows, and other shapes from scratch much easier. You can fill objects with materials and convert them to 3-D with push-button ease. Bezier-type deformation bends any object or text into an organic shape. And with the new drag-and-drop wraps, you can make text fit curves. These curves,

however, are not editable.

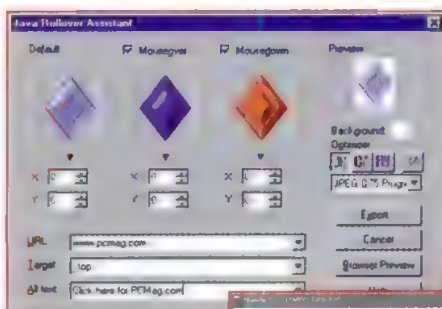
Object-based image editing and painting are more versatile. For instance,

brush strokes can be set to create a new object rather than merging into the underlying pixels. But thumbnails in the special effects dialogs continue to be too small.

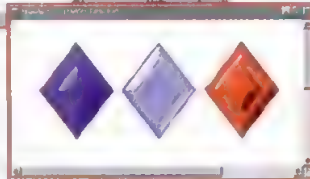
Using keyframe editing, dazzling new lighting effects can be output as GIF animation. PhotoImpact includes Ulead GIF Animator 3, which offers new features, such as moving sprites and HTML export.

PhotoImpact can be difficult to learn. The Help tutorials and menu are limited in scope, and the location of some commands do not follow industry standards. But overall, it is a remarkable value that offers creative power and a quick, smooth workflow.

PhotoImpact 5. Street price: \$79.95 (\$49.95 upgrade from PhotoImpact 4 and a \$20 rebate for competitive upgrades). Requires: 32MB RAM; 180MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. Ulead Systems, 800-858-5323; www.ulead.com.



BUTTONED UP: The new Java Recover Assistant quickly builds buttons for Web pages.





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* SOFRES/InterSearch Windows OS User Reliability Study (6/98). Participants using Windows NT Workstation were about three times less likely to experience serious system stoppages than Windows 95 users surveyed.

† Price is estimated street price. Actual price may vary. Monitor not included.

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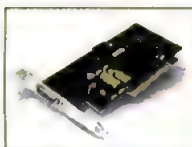
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Separated at Birth?

The eMachines eOne resembles the iMac but offers several improvements over Apple's all-in-one design.

By Cade Metz

Whether it's an imitation of the Apple iMac or not, eMachines' latest low-cost desktop is a welcome addition to the sub-\$1,000 PC market. Though priced from \$399 to \$799 after rebates, the eOne includes up-market I/O hardware and is far easier to set up and use than almost any Windows 98 PC. (Free technical support is limited to 15 days.)

A translucent-blue system with built-in monitor and speakers, the eOne has understandably sparked a lawsuit from Apple. But in many ways, the eOne improves on the iMac design, offering a floppy disk drive, a CD-ROM drive with external controls, video-input hardware, and a home network adapter. Considering the iMac costs at least \$250 more, such improvements are hardly insignificant.

The floppy disk and CD-ROM drives are situated on the system's front panel, below a 15-inch display and between its two stereo speakers. Though sound quality is mediocre, you can play audio disks even when the machine is powered down. The front panel also includes easily accessible USB, headphone, and microphone ports.

As with the iMac, there's a second USB port, an Ethernet jack, and a modem jack; but there's also a NTSC video-in port, two audio-in ports, and a home network connection. With the latter—compatible with Intel's AnyPoint network—you can connect to several other household PCs and share files, printers, and Internet access.

Internally equipped with a 433-MHz Celeron chip, 64MB of SDRAM, and an ATI Rage Pro XL graphics engine, the eOne managed to score only 17.7 on our ZD Winstone test and 192 on the 3D WinMark test. The PC

is ill-suited for high-end games, but it handles other home applications adequately and provides capable video playback.

What's surprising is how carefully the eOne has been designed and documented—how easy it is to set up and use. Merely connect a power cord, a keyboard, and a mouse, and the machine is fully operational.

At the moment, the eOne is sold exclusively through Circuit City stores, but eventually it will

► **LOOK-ALIKE:** The all-in-one eOne includes a floppy disk drive and lots of ports.

be available from other retailers nationwide. All buyers are given a \$50 mail-in rebate coupon, while those who opt to use the machine's CompuServe 2000 Internet service can receive an additional \$400 rebate. Of course, CompuServe 2000 will cost you \$21.95 per month for 3 years. But the eMachines eOne is nonetheless a bargain.



eMachines eOne. Street price: \$849 (\$799 after rebate). eMachines Inc., Irvine, CA; 877-566-3463; www.e4me.com.

Dell Downsizes Notebook

The overhauled Latitude C series brings the first thin-and-light system to Dell's corporate notebooks.

By Cade Metz

Filling an obvious hole in Dell's long-standing line of corporate notebooks, the \$2,899 (direct) Latitude CS includes a full-sized keyboard and a 13.3-inch display, yet it weighs just over 4 pounds. Though the CS chassis can't hold a floppy disk or CD-ROM drive, it conveniently attaches to the "media bay" drives, the port replicator, and the docking station used by existing Latitude C series machines.

The CS resembles Fujitsu's LifeBook L470, which also has a 13.3-inch display and weighs 4.3 pounds.

These two systems are among the few mainstream notebooks that measure less than 1.2 inches thick (even the average mini-notebook is thicker).

Despite its single-spindle chassis design, the CS is a reasonably powerful machine, housing a 400-MHz Pentium II, 64MB

of system memory, a 4.8GB hard disk, and NeoMagic graphics. Scoring a modest 16.9 under Winstone, it needs a faster hard disk to compete with the market's fastest notebooks, but it should perform well under most mainstream software.

Equipped with a lithium ion battery, the system has a battery life of merely an hour and 45 minutes, a few minutes under that of the average thin and light portable. Furthermore, its power management (PM) interface is split awkwardly between BIOS and Windows; many

users will want a consolidated PM interface.

Existing Latitude C series portables are equipped with what Dell calls a *media bay*, a bay on the side of the system that accepts floppy disk drives (bundled with each system), CD-ROM drives (\$99 apiece), LS-120 drives (\$199), and 10GB secondary hard disks (\$499). Cleverly, Dell ships the CS with a similar bay that attaches *externally* to the system via a short cable, allowing you to use any available media bay device. Likewise, the CS plugs into the existing Latitude port replicator (\$399) and the existing docking station (\$699), which we used to great effect at PC Labs.

Dell sweetens the Latitude CS package by providing a three-year parts and labor warranty and next-business-day on-site service. Despite its limitations, the Dell Latitude CS is a great addition to the Latitude line.

Dell Latitude CS. Direct price (with a 13.3-inch display, Pentium II/400 processor, 64MB of memory, and a 4.8GB hard disk): \$2,899. Dell Computer Corp., Austin, TX; 800-388-8542; www.dell.com.



◀ **NOTABLE:** Just 1.2 inches thick, the Latitude CS is slimmer than most mininotes.

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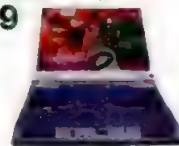


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FIRST LOOKS



AutoPC: In First Gear

The Clarion AutoPC demonstrates the platform's promise but gives few reasons to buy it today.

By Bruce Brown

First announced in January 1998, the Microsoft Windows AutoPC is now available throughout the U.S. Though all major car stereo equipment manufacturers were on board for the platform introduction, Clarion Sales Corp. was charged with developing the first version of AutoPC with Microsoft and bringing the new product to market. The Clarion AutoPC's base unit (\$1,300 street) was first sold in limited markets in September 1998; now it sells nationwide through Clarion dealers, with a list of options that can more than double the price.

We tested a fully loaded version of the Clarion AutoPC (\$2,920 street, as tested) in a drop-dead-gorgeous, special-edition Infiniti I30, and we found an intriguing combination of entertainment, information, navigation, communications, and security features. However, the base unit's perfor-

mance capacity was overtasked by all of the options (plus some added features included in the preproduction version), which slowed the system's response and dampened our enthusiasm. The greatest appeal of the AutoPC is the integration and interaction of its multitude of features, but the base platform (CPU and memory) needs to be pumped up to meet the challenge.

In-Dash Device

The Clarion AutoPC installs in a single-bin radio compartment in an automobile dashboard. The unit must be installed by a Clarion dealer, who also provides initial training. Other training aids include an owner's manual, an introductory video, and help online at Clarion's Web site (www.autopc.com).

The base unit, which includes a 66-MHz Hitachi SH-3 CPU with 8MB of ROM and 16MB of RAM, has an eight-color, 256-by-64 active-matrix LCD screen

on a removable faceplate. Other features on the faceplate are a joystick-like Pointer/Enter control; a tiny telephone-style alphanumeric keypad; separate power, volume, mute, help, menu, and voice-memo buttons, and a Windows button that brings up the icon-based features menu on the LCD. There's also a button labeled Assist, intended for use with a future optional assistance-calling product similar to the General Motors OnStar system.

The AutoPC has a CompactFlash slot for backing up applications, user settings, and data, and a dual-speed infrared transceiver currently used only for transferring contact information from a Windows CE H/PC or P/PC to the AutoPC address book. When you tilt the faceplate down, you'll find a single CD-ROM drive that can read both data and audio CDs.

The audio system, which replaces your auto's existing system, is impressive—as you'd expect from Clarion, a major after-market car-audio vendor. With a total of 140 watts (four channels at 35 watts each), the system has ten AM and ten FM presets, plus a ten-band digital equalizer able to contain three

equalizer setting profiles for different music styles or user preferences.

The AutoPC also includes a four-channel preamp output and an integral microphone system for detecting voice commands. And the unit can control an optional six-disk CD changer for audio CDs only (\$400 street), which was installed in the glove compartment of our test car.

The unit's LCD was bright and easy to read, but the system isn't designed to require the driver to look at the screen often, if at all. All menu selections are announced by a computerized voice with adjustable pitch, and all content can

be read to you. A voice command vocabulary with 200-plus words (which can be augmented with voice macros) lets you switch among and control all the AutoPC applications.

The test system was equipped with an excellent Andrea AutoArray DA-300 super-directional microphone (\$220 street) that clipped to the sun visor; it did a great job of recognizing quiet voice commands, even when the stereo was blasting away. Many people are justifiably concerned about driver distraction with in-car electronics, but the AutoPC is designed to minimize distraction: Even the radio and CD changer can be controlled by voice command.

Software for the Road

Applications bundled with the basic AutoPC, in addition to the audio entertainment features, include an address book and a voice-memo recorder. You enter new contact info (laboriously) via the AutoPC's alphanumeric keypad or by selecting letters and numbers one at a time with the pointer. The best way to put contact data into the AutoPC is by infrared beaming; the unit works smoothly with any Windows CE hand-

held or palm-size unit.

The first sign that our test system had more options installed than was probably reasonable for the CPU and signal bus was that the address book took several seconds to load, even with just a few contacts. When you add these options to the system, however, the true extra value of the platform begins to emerge.

You Are Here

Our test system was equipped with a GPS receiver (\$250 street) and a combination of InfoGation Crop's Odyssey car navigation software and a single NavTech Map Data CD (\$200 street for the combination). NavTech has road network and POI (point of interest) data for the continental U.S. on a total of nine regional CD-ROM disks (each additional regional disk costs \$150). NavTech map data is the U.S. standard, and the Odyssey application uses a combination of moving maps and next-turn directions with voice announcements of upcoming turns.

The NavTech data does best in major metropolitan areas. In less populated areas, it contains network information only for major roads. When we tested in Manhattan, Long Island, and northern New Jersey, the system worked reasonably well—although NavTech's didn't find Manhattan's East 28th Street (*PC Magazine's* location) in its database, and the Odyssey software started sending us to 28th Avenue in Queens.

We found that the GPS system took an unusually long time to initialize, but once the system figured out where we were by reading satellite transmissions, it did a good job of maintaining contact. Unlike the BMW's and some other in-car systems, there's no dead-reckoning backup using inertia or wheel movement—so if you lose contact with the satel-

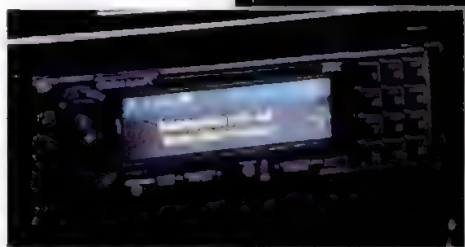
where you are until you regain an

unobstructed satellite view.

Previously tested GPS systems used with notebook PCs in cars have been able to determine our location in most areas in Manhattan within a minute or less. During one test of the AutoPC, we left a midtown Manhattan hotel and headed for New Jersey, and the system didn't find us until we emerged from the Lincoln Tunnel. But it didn't lose us as we traveled around suburban New Jersey and back into Manhattan (except for a brief interlude in the tunnel).

Other Options

Our test car had options for both wire-



less and telephone communications. The CUE Wireless messaging service (\$170 street plus usage fees) enables an AutoPC-equipped car to receive news and weather messages. Optional services include nationwide traffic alerts for \$60 a year (you can select only the sectors in which you travel so that you won't be inundated with messages), plus numeric paging, text paging, e-mail alerts, and voice e-mail at varying rates, depending on coverage and usage. Our test system was set up for e-mail messages, but all we received was an alert, not the 40-character message header we were told to expect.

The CUE Wireless network can also work in combination with the Vetronix CarPort (\$400

1996 vehicles and later) to mon-

itor vehicle speed and RPM profiles (so you can check whether parking lot attendants abuse your car), for maintenance reminders and expense tracking, and for remote vehicle system operation (call it with a cell phone to blink your lights and blow the horn to find it in a parking lot).

CarPort was installed in our test car (according to Clarion, it was a major source of the AutoPC's sluggishness) but only the speed and RPM monitors were

phone and works in conjunction

with the AutoPC voice-command system and audio volume. When a call comes in, the Phone Base mutes the audio system and works as a hands-free system. Outgoing calls also mute radio and audio CD volume from the time you press the first digit of a phone number until you press the end key.

This integration of audio and telephone volume worked perfectly. The production-level Phone Base is also supposed to dial by selecting numbers from the AutoPC address book using voice commands, but this feature wasn't yet working.

The Last Lap

The good news about the Clarion AutoPC is that the system works: It's usable without significantly distracting the driver and, particularly when loaded with all the options, it has a number of truly useful features for travelers and mobile professionals. The bad news is that the AutoPC is expensive for an aftermarket automobile accessory, and that if it's fitted with all options, performance can lag.

Future versions of the AutoPC from Clarion—and similar items from other manufacturers—will likely be faster and less expensive. But if you want in-car computing right now, the Clarion AutoPC offers real value compared with purchasing components separately. Pick your options carefully and don't install the whole enchilada, however, and system response should improve.

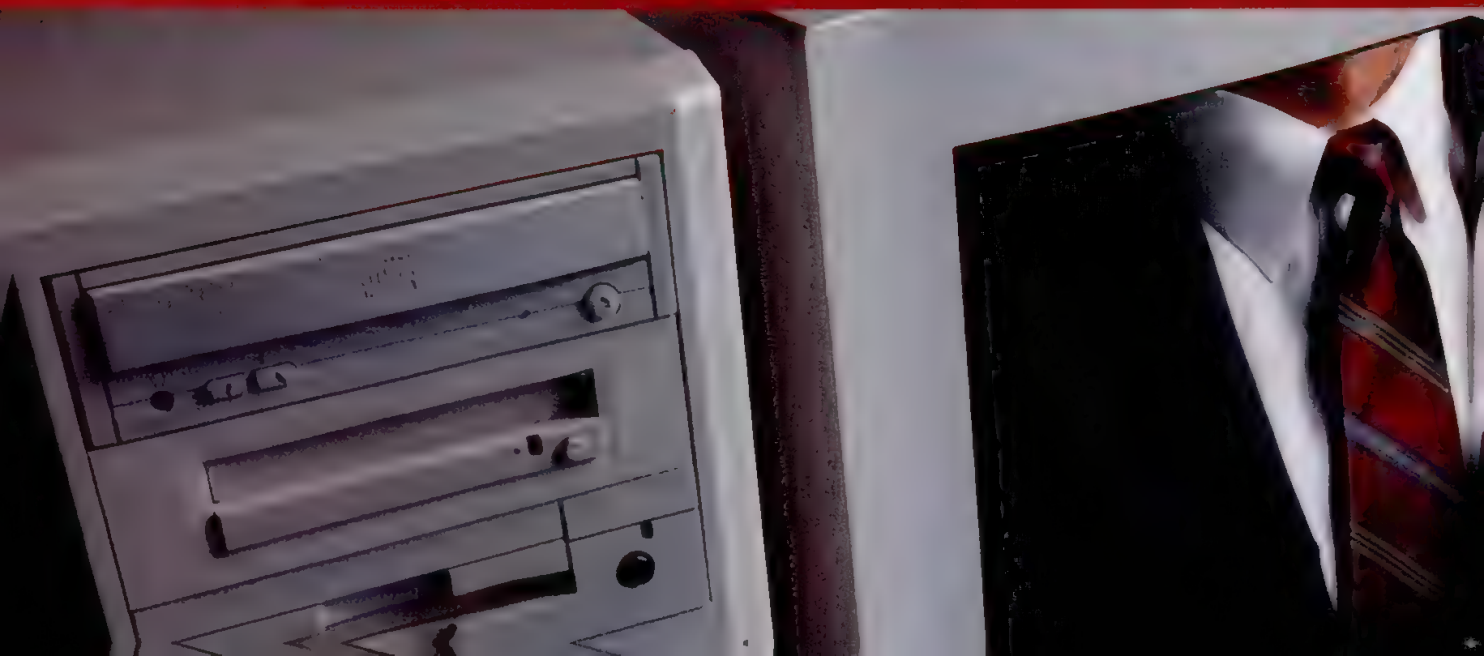
Clarion AutoPC. Street price: Base unit, \$1,300; as tested, \$2,920. Requires: Single-bin car radio slot; 1996 vehicle or later, with

AUTOPC ACCESSORIES: Options on our test system included a GPS receiver and a cell phone attachment.

enabled. One of the most valuable features of the CUE Wireless system in conjunction with CarPort is the Car-Jack Vehicle Recovery: If your car is stolen, a call to the CUE system will activate the car's lights and horn and then disable the car after it is parked and turned off. CUE Wireless and CarPort can also be used for such (less dramatic) purposes as remote car locking and opening the windows on a hot day.

The last option installed in our test system was the near-final beta version of the Nokia

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Get Down to E-Business

Bigstep.com and eCongo offer free online services to help you to open your own Web storefront.

By Neil Randall

Whoever said there's no such thing as a free lunch had obviously never used the Web. Nowadays, Web sites are providing e-mail, address books and appointment calendars, faxing, and many other services gratis. In some cases, the free service is simply designed to lure users back to the site repeatedly; in others it's meant to entice users to purchase additional services. The latter idea is the premise behind two new, free storefront services, Bigstep.com and eCongo.com.

Storefront services let you sell your wares over the Web. Of course, you can do this with your own server running e-commerce software, but that requires equipment, technical expertise, and time. If you're a small business owner and want a Web storefront but have little money, expertise, and even less time, a storefront site can host your online sales service for you. It's a good idea, and even better when it's free.

Both storefront services were in public beta at the time of this writing. We preferred Bigstep.com to eCongo.com for its more extensive range of features, but at this price, you can try them both if you like.

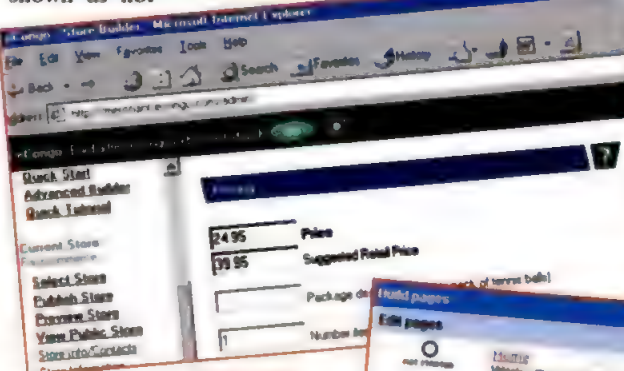
Bigstep.com

Bigstep.com offers an impressive array of features. After filling in a form with company and contact information, you're taken to the site creation area, where you can select from six different activities.

The first, Site Building, takes you through registering a URL for your business (in the form *bizname.bigstep.com*), then through a well-designed basic or advanced system (you can switch

between them) for preparing the colors, layout, and font choices for your site. You can also use your own domain name.

Site Building also gives you a wide variety of topic pages to create, ranging from the typical About Us page to surveys, events lists, job listings, and Q&A. Each page or activity is shown as not



▲ ON SALE:

Using eCongo.com's administrative features, you can set promotions or special offers.

started, started, or ready to publish.

Where Bigstep.com really shines is in its remaining site creation activities. The Communication area lets you create a multiple-choice survey for feedback from your customers. As you gain insight about your site's shoppers, you can develop a customer database and subscriber groups.

In the Catalog area, you can develop a catalog with its own layout and appearance. The Marketing area lets you create e-mail newsletters for your customers and submit your site to search engines on the Web. The Reporting feature (not available at this writing) will provide you with your own site analysis tool.

In the Commerce area, you can apply for a merchant account; this costs \$14.95 per month plus 15 cents per transaction and is the first of the added-

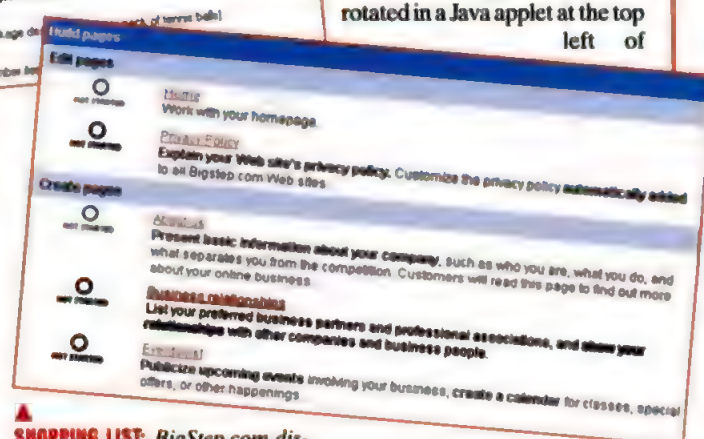
cost features that Bigstep.com will make available to its storefront owners. Other premium services to be introduced later this year include discounted banner ad buys, prospecting lists, and more comprehensive search engine registration options.

Bigstep.com. Price: Free. Requires: Microsoft Internet Explorer or Netscape Navigator Versions 3.0 or later. Bigstep.com Inc., San Francisco; 415-229-8500; www.bigstep.com.

contact information, and you can also specify multiple phone numbers and multiple URLs. You can enter images for your store and its logo, payment methods you accept (the credit card option was not available in the early beta version), and how frequently you want to be informed of orders (instantly, hourly, or daily).

The next step is creating the guts of your storefront—the departments and categories into which you'll separate your products. Inside each category you can list multiple items with inventory numbers and prices and whether the item is being offered as a promotion or a special.

eCongo.com also offers an easy means for providing your own FAQ page, a policy for returns, a detailed store focus, and a form for creating ads. The ads are rotated in a Java applet at the top left of



▲ **SHOPPING LIST:** BigStep.com displays all the tasks you need to perform to open your doors online and tracks your progress.

eCongo.com

Like Bigstep.com, eCongo.com starts you off with a merchant ID and password before it launches its storefront creation process. You then have the choice of Quick Start or Advanced Builder. There's not a huge difference between the two, and you can switch from one to the other, but we recommend Advanced Builder because it lets you input additional information up front.

You must provide store and

your storefront's pages.

eCongo.com's premium services will include real-time credit card transaction processing, micropayments, advertising analysis, multistore administration and credit card fraud protection. Once you add everything you need—you're able to modify your store at any time—you can preview it to make sure it works, then publish it in eCongo.com's list of storefronts. **eCongo.com.** Price: Free. Requires: Microsoft Internet Explorer or Netscape Navigator Versions 4.0 or later. eCongo.com Inc. Los Gatos, CA; 877-871-7980; www.eCongo.com.



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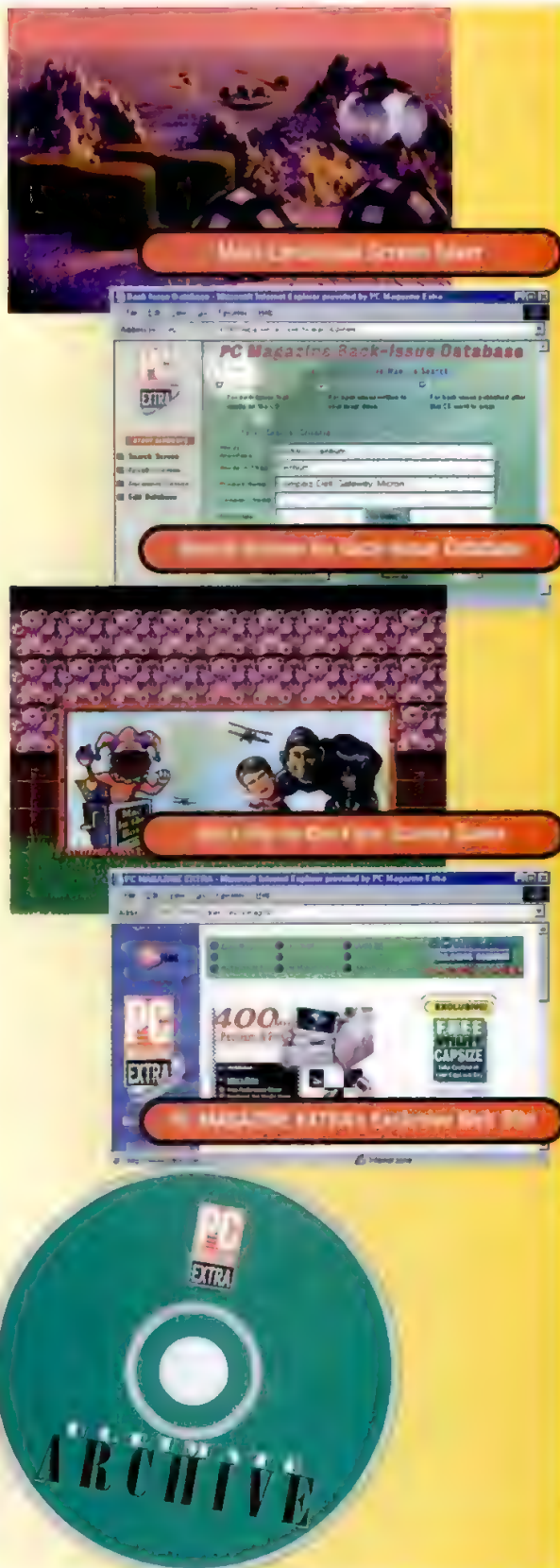
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Psion's Newest Import

The Psion Series 5mx is a capable PDA that gets along with a wide range of desktop applications.

By Bruce and Marge Brown

Long popular in Europe, the Psion line is catching on in the U.S. The latest addition is the Psion Series 5mx (\$500 street). Packed with a faster processor, more memory and expansion options, a Java-compatible EPOC OS, and enhanced data synchronization and mobile communications, the 5mx deserves a close look.

The 5mx has a 36-MHz ARM710T RISC processor, 16MB of expandable RAM, a CompactFlash card slot, and an infrared port. The device also comes with a serial cable and a PsiWin2 CD with PC connectivity applications, a Web browser that runs Java, preset configurations for ISPs, user guides, and synchronization conduits for an extensive list of desktop appli-

cations, including Corel WordPerfect Suite, Lotus SmartSuite, and Microsoft Office. And the Psion's Java sup-



SLIDING DOOR: When you open the 5mx, the relatively large keyboard slides toward you.

port has sparked rapid growth in the development of third-party applications.

With an infrared connection between the Psion Series 5mx and a dataphone with a built-in modem, such as the Nokia 8810 or Ericsson SH888, you can send a fax, send and receive e-mail, and connect to the Internet. If you have a GSM phone without a built-in modem, you'll need a PC Card modem adapter (\$189 list) and a GSM PC Card (\$199 list). Wired connectivity is available with a travel modem or PC Card modem adapter with a PC Card modem (\$199 list).

The 5mx has a distinctive cover that, when opened, slides the keyboard forward and tilts the screen back. The backlit touch screen provides full-page-width viewing, but we found the menus difficult to read in their small font size.

Using the QWERTY keyboard is the only means of inputting data, unless you use the self-contained Sketch application or install third-party handwriting-recognition software. Although incorporating a keyboard in a device of this size is a design marvel, we still found typing to be uncomfortable.

During testing, our 5mx's case literally became too hot to handle, because of a defective spring that failed to make proper contact with the battery. According to Psion, only a small number of initial production units had this defect.

The 5mx faces a crowded hand-held computing market in the U.S. But for those who need compatibility with a broad range of desktop applications and comprehensive connectivity options the Psion Series 5mx has no peer.

Psion Series 5mx. Street price: \$500. Psion Inc., Concord, MA; 800-997-7466; www.pSIONUSA.com.

A Pager Gets Smarter

Starfish's TrueSync software makes the Motorola PageWriter 2000X a better companion device.

By Bruce Brown

The newest two-way pager from Motorola, the PageWriter 2000X (\$360 street), is now available with TrueSync software. The addition of this versatile standalone PIM and synchronization package means that in addition to gaining high-powered wireless paging, messaging, e-mail, and Internet query services, PageWriter 2000X users also are better able to manage desktop and pager contacts, calendars, lists, and memos.

The PageWriter 2000X, which boosts on-board memory to 4.5MB from the previous PageWriter 2000's 1.5MB, also adds lighted keys, a black case, and updated FLEX operating system software. The pager's 49 keys are augmented by the NavDisc, a round navigation button.

To use the PageWriter 2000X, you'll need two-way paging service from Office Depot, PageMart, or SkyTel.

The Motorola pager measures 1.2 by 3.75 by 2.8 inches (HWD). Included in the bundle are a belt clip and a docking station/battery charger. The docking station is used to connect the PageWriter 2000X to a PC via serial cable using an infrared connection between the pager and dock. During two months of testing, the nickel hydride battery, which recharges in an hour, lasted consistently for about a week, as rated.

The TrueSync software package includes two applications: TrueSync Desktop for PageWriter is a standalone desktop PIM for managing contacts, tasks, events, memos, and phone calls. And TrueSync Plus for

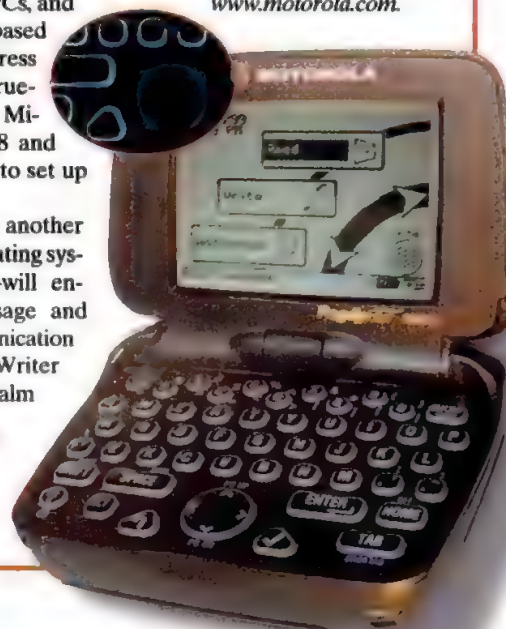
PageWriter lets you synchronize databases created using major PIM programs and hand-held devices.

For gadget lovers, TrueSync Plus enables synchronization with a number of connected devices at the same time, including 3Com Palm organizers, REX and REX PRO PDAs, Windows CE H/PCs and P/PCs, and Yahoo!'s Internet-based Calendar and Address Book. We tested TrueSync Plus with Microsoft Outlook 98 and found it easy both to set up and to use.

Later this year, another version of the operating system—FLEX 3.0—will enhance memory usage and allow direct communication between the PageWriter 2000X and 3Com Palm

and Windows CE devices via infrared. Current devices will be able to upgrade to the new OS via flash downloading, which will make the Motorola PageWriter 2000X an even more appealing productivity tool.

Motorola PageWriter 2000X. Street price: \$360. Motorola Inc., Bounton Beach, FL; 800-548-9954; www.motorola.com.



SHED LIGHT ON IT: The PageWriter 2000X has more memory and backlit keys.

"I wanted the best protection available and APC delivered."

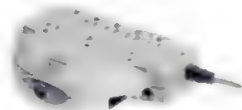
— Fred Lugano, weatherization.com, Vermont

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Symantec's Latest Suite

The new Norton SystemWorks 2000 delivers a harmonious bundle of useful utilities.

By Larry Seltzer

Although Norton SystemWorks 2000, the latest version of Symantec's Windows utility suite, adds little in the way of new functionality, the suite's components are far better organized. SystemWorks 2000 combines the classic Norton Utilities, Antivirus, and CleanSweep into a single, integrated system.

SystemWorks 2000 comes in two editions: Standard (\$70 street) and Professional (\$100). In addition to the features in Standard, Professional has Norton Ghost, which lets you create images of hard disks in order to archive them or transfer them to other systems, and Norton 2000, an unimpressive Y2K diagnostic tool.

With SystemWorks 2000, you use Norton Integrator, a single program with buttons on the left for each major utility category, to choose which utility you'll work with. The programs are built with a new plug-in archi-

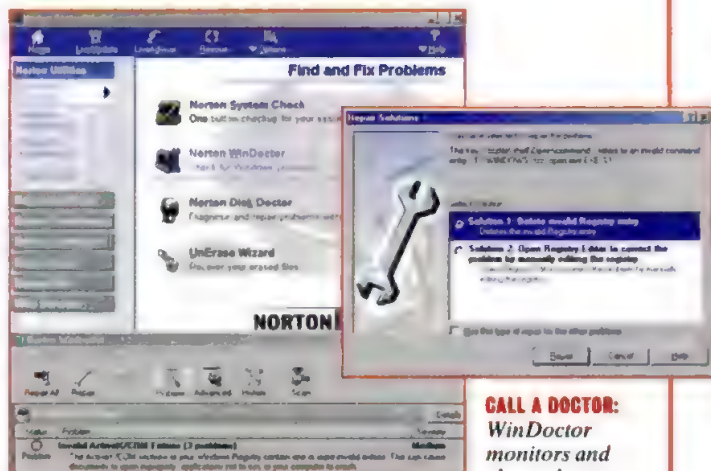
tecture, so that Symantec can easily ship new or replacement components in the future.

Atop Integrator's window are buttons for easy access to suite-wide functions. LiveUpdate updates SystemWorks over the Web, and LiveAdvisor is a window in which Symantec pushes information about new viruses, product updates, and more. Rescue lets you create a Zip disk or a set of floppy disks from which to recover a damaged system.

You can move one or two levels down in Norton Integrator until you select a precise operation, such as restoring an erased file. You then move beyond the common interface and into the distinct utility you need.

Individual functions are increasingly integrated with each other. For example, if Norton Utilities determines that disk space is low, it calls on CleanSweep to help free up some space.

You can run programs such as DiskDoctor, WinDoctor, UnErase, and WipeInfo right from



CALL A DOCTOR:
WinDoctor
monitors and
cleans the sys-

tem, presents a list of problems, and fixes them itself or lets users manually fix them.

ed this with a variety of macro viruses and a few others, and the utility found and cleaned them all. Only POP3 mail clients are supported: Corporate MAPI and Lotus Notes clients are not, nor is Microsoft Outlook Express when using Web-based mail such as Hotmail.

We ran into sporadic problems on our tests. For example, the UnErase wizard, which guides you through recovering a deleted file, has a QuickView feature that should let you preview the file. But each time we clicked the button, we got an error message saying that the View process failed to load. Symantec explained that this happened because QuickView is not installed by default, but the error message won't help users determine how to get the component to work.

Small problems aside, though, Norton SystemWorks 2000 is a clear improvement on an already excellent product.

Norton SystemWorks 2000. Street price: Standard, \$70 (\$10 rebate for upgrades); Professional, \$100 (\$20 rebate for upgrades). Requires: 16MB RAM; for Standard, 106MB hard disk space; for Professional, 114MB hard disk space; Microsoft Windows 95 or 98. Symantec Corp., Cupertino, CA; 800-497-6180; www.symantec.com.

stalls a Windows VxD and normal McAfee virus-description (DAT) files, your system has virus protection even when you are not online.

The Clinic services come as a single package only, with an initial yearly fee of \$19.95 that will eventually rise to \$39.95. ActiveShield currently doesn't scan ZIP files or e-mail, but these capabilities will be added later: Since the service is Web-based, upgrades are included in the fee and are automatic: The antivirus control checks the McAfee.com site once a day for updates. This service can be a real boon for anyone who is too busy to remember to check regularly for virus updates.

McAfee Clinic with ActiveShield. Direct price: \$19.95 yearly. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 95 or 98, Microsoft Internet Explorer 4.0 or later: McAfee.com Corp., Santa Clara, CA; 877-822-3331; www.mcafee.com.

Virus Protection Goes Online

It's not enough to merely install an anti-virus program. For effective protection, you need to keep it updated continuously. Now McAfee Clinic, a Web-based subscription service at McAfee.com (www.mcafee.com), makes this much easier, with a new component called Continuous Protection. Using McAfee's ActiveShield technology, the service provides strong antivirus protection and scans automatically for updates. Clinic also includes a disk cleanup tool, a system performance optimizer, and a software update finder; all ActiveX-based versions of the capabilities in McAfee VirusScan, Uninstaller, and other conventional tools.

The user interface is entirely Web-based, so to scan files on your system manually, you must be online and connected to McAfee.com's Scan Now page. However, because Continuous Protection downloads and in-

stalls a Windows VxD and normal McAfee virus-description (DAT) files, your system has virus protection even when you are not online.

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McAfee Clinic with ActiveShield. Direct price: \$19.95 yearly. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 95 or 98, Microsoft Internet Explorer 4.0 or later: McAfee.com Corp., Santa Clara, CA; 877-822-3331; www.mcafee.com.

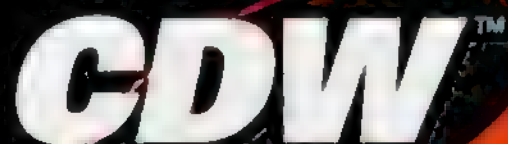
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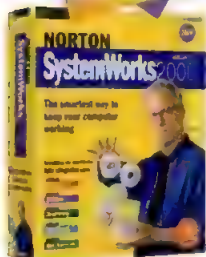
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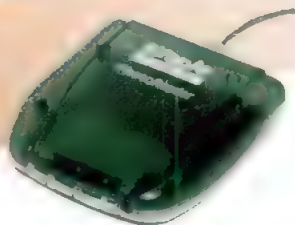
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Home Network, No Wires

With WarpLink, from Acer NeWeb, wireless home networking is simple and affordable.

By Les Freed

Wireless home networks have become hot items. Joining the fray, Acer NeWeb Corp. (a division of Acer America Corp.) has launched its WarpLink Wireless Network system for sharing Internet access and printers and transferring files (\$100 per PC, street). Although Acer's 1-Mbps system doesn't conform to the 802.11 wireless networking standard, the WarpLink's price is hard to beat, and the system is easy to install.

Acer offers several WarpLink packages, each with different combinations of USB, ISA, and PC Cards. All use a proprietary radio system, Frequency Hopping Spread Spectrum, which operates in the 2.4-GHz band.

We tested the ISA and PC Card versions of the product. Both were simple to install, although the ISA card's rigid antenna prevented us from installing the card in the right-most slot of our test PC, a Compaq Presario 5660. Similarly, the PC Card antenna sticks up from the end of the PC Card, which puts it just to the right of the Shift and Enter keys on a notebook PC.

The software drivers and WarpLink utilities come on a single CD. The WarpLink network utility program resides in the system tray and lets you check your wireless network via a graphical interface.

Acer bundles a four-user version of SyGate, which provides excellent Internet sharing capabilities. SyGate uses Name Address Translation (NAT) to provide shared Internet access over a network using a single IP address. We tested SyGate with both a shared Dial-Up Networking connection and an @Home cable modem connec-

tion. Both worked without a hitch.

The company claims a maximum speed of 1 Mbps with a range of 500 feet in an open space or 150 feet in a typical home environment. In testing, the WarpLink's speed maxed out at around 600 Kbps with the units in close proximity. This is more than enough speed for all but the fastest Internet connections, and it's also fast enough for effective printer and file sharing.

We're usually not crazy about proprietary systems, especially when there's a standard in place. But the currently competing 802.11-compatible systems start at around twice the price of the WarpLink unit and do not include Internet sharing software. For these reasons, the Acer WarpLink Wireless Network is a fine interim solution for easy, inexpensive homenetworking. **Acer WarpLink Wireless Network.** Street price: \$100 per PC. Acer



▲ **WARP SPEED (ALMOST):** The Acer WarpLink Wireless Network is fast enough for jumping Internet Access.

NeWeb Corp., San Jose, CA; 800-368-2237; www.shopacer.com.

Internet Access for All

WinProxy 3.0 adds new features and enhances ease of use to a powerful proxy server.

By Les Freed

One of our favorite tools for sharing Internet access over a LAN has long been Osis Software's WinProxy (from \$59.95 direct for three users to \$699.95 for unlimited users). But our major gripe with WinProxy and most other proxy server software

server, providing shared Internet access for all the PCs on a LAN. WinProxy can share any type of Internet connection including dial-up, ISDN, DSL, and cable modem. If your Internet connection device uses an Ethernet connection (as do most cable and DSL modems), then you need two Ethernet cards in the WinProxy server PC: One connects to the LAN; the other, to the Internet. WinProxy's built-in firewall provides a layer of protection between your LAN and the outside world.

A new wizard installs WinProxy 3.0 and walks you through the basic server configuration

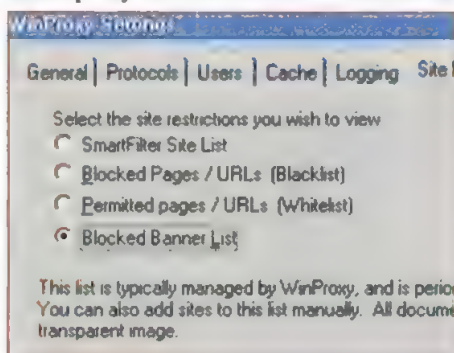
WinProxy 3.0's new Transparent Proxy feature provides automatic client configuration and address assignment using the DHCP protocol. This eliminates the need to set IP, DNS, or gateway IP address settings on each client PC. As each PC boots, it obtains its IP address and proxy settings automatically from the WinProxy server.

WinProxy 3.0 is loaded with new features. In addition to site blacklisting, which blocks users' access to specified sites, Version 3.0 adds a site whitelist. With the whitelist enabled, users can access only those sites approved by the WinProxy administrator.

WinProxy 3.0's built-in virus checker, based on Trend Micro's antivirus technology, checks inbound files for viruses on the fly. Other new features include a site-filtering tool (using Smart Computing's SmartFilter technology), a banner ad blocker, and improved compatibility with AOL and MSN.

WinProxy 3.0 combines the easy Internet access sharing of a Name Address Translation server with the performance of a proxy server.

WinProxy 3.0. Direct price: From \$59.95 for 3 users to \$699.95 for unlimited users. Osis Software, Pleasanton, CA; 925-734-1900; www.ositis.com.



▲ **STUMBLING BLOCK:** One of WinProxy 3.0's new features, a banner blocker, replaces ads with transparent images.

packages was that they required proxy-aware Internet applications, and those applications often needed manual tweaking. WinProxy 3.0 addresses all these issues and adds several new features.

Like previous versions, WinProxy 3.0 acts as a caching proxy

tion steps in about 10 minutes. As part of the installation process, a text file that contains instructions for installing and configuring your client PCs is generated. If you change the configuration later, the program generates an updated set of client configuration instructions.

Service with a Frown

By Carol Venezia

As PC hardware becomes more of a commodity item, vendors are looking for new ways to distinguish themselves from their competition. After all, if you can get pretty much the same parts from every company out there, some incentive to shop in a particular place is welcome. For most major vendors, the big differentiation point right now is service and support. That's why we're seeing more Web sites geared toward helping customers solve their problems, not to mention PC-vendor-as-ISP offerings, à la Compaq.net, Dell-net.com, and Gateway.net.

So which companies are doing the right thing for their customers in the realm of service and support? To find out, we first asked our subscribers in a survey conducted earlier this year (July issue, page 183). And more recently, we asked our online audience to tell us about its experiences. Were they blissful or nightmarish? We heard a bit of each, but mostly the latter.

We were quite surprised to see accounts of Gateway's automated support-line problems from more than one person. Seems

that if the automated operator behind Gateway phone support decides the lines are too busy to put one more person on hold, you get disconnected. Note to Gateway: Fix this. People dislike being hung up on, especially when they're dialing the number you gave them to call for help. One reader pointed out that if you call Gateway's sales line, you don't get cut off. Hmmm....



Another of our discussion participants shared an experience that may be valuable to many of you. He bought a Gateway notebook through Onsale.com and found out after the purchase that he can't buy parts directly from Gateway, because he didn't buy the notebook directly from Gateway. In this case, the item was a small plastic hinge that, had he bought the notebook from Gateway, would have been replaced free

of charge. Given the growing popularity of online auction sites such as Onsale.com, this is an issue customers should know about in advance.

So which vendor gets two thumbs up from our Second Looks discussion? Looks like Apple, Dell, Hewlett-Packard, and NEC received kudos for providing good service, but one reader who shared his Apple PowerBook experience didn't have to call for service at all. His PowerBook worked flawlessly right out of the box—and has continued to do so ever since. Touché.

Machines of Many Talents

By Bruce Brown

Perhaps this category qualifies as a public secret: Everyone knows about the devices, but many don't realize how good they really are. If you're just starting out in computing, or if you're setting up a new home or small office and need to buy everything, it's hard to beat the deal you get with a multifunction device. Not only do you save money (and time) by not having to shop for multiple devices, but also you have to buy only one set of consumable supplies.

People who use multifunction devices generally like them, but not everyone is convinced the devices are such a good idea. Our reader respondents chose multifunction machines from brands with which they were familiar (specifically Canon and Hewlett-Packard) and reported being very pleased with the output quality and satisfied with the performance speed. But of course, not everyone feels this way.

Interestingly, no one mentioned breakdowns as a concern. Printer vendors report that multifunction units do not have a greater incidence of failure than printers, scanners, or fax machines—which means they don't fail very often. Apparently, this aspect is not a major problem.

In our case, we purchased a multifunction device several years ago when our conventional fax machine died. We wanted a unit that had a good multiple-page feeder and decided to buy a multifunction device that could also serve as a backup printer and scanner (even though we already had stand-

▲ **ALL-IN-ONE:** Multifunction devices such as the HP OfficeJet R60 make a lot of sense.



alone devices) as well as a multi-page copier to augment our now-ancient Canon single-page desktop copier. We purchased a Brother MFC-4500, a monochrome laser model that had won an Editors' Choice award earlier that year, and the unit is still a faithful performer four years later.

Newer multifunction models tend to be ink jet-printer-based, with color photo-printing and -copying features that are appreciated and used by their owners. If our readers' and our personal experiences are representative, the versatility and convenience of all-in-one devices outweigh any potential drawbacks. **PC**

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Tell us what you think....How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of multifunction devices.

I wouldn't buy one. Simply put, I don't want to have to buy a new printer when I want to upgrade the scanner built into it. I like having the opportunity to keep my peripherals until they are down and out, because sometimes the older stuff does what you need it to do.

—Joel McLaughlin

We own both an HP OfficeJet 1150C and an HP OfficeJet R80. My comment is they are truly wonderful machines. Our 1150C is about three years old and has done yeoman service. My wife copies photos that are suitable for framing. And the photo quality of the R80 is superb. Printing on both machines is a pleasure. We won't be without one of these, ever.

—Bud Simmons

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Peripheral Adventures

I can't quite remember the last time I bought a printer. My newest printer is an Epson Stylus Pro. My laser printer is an HP LaserJet 4. My "Sunday" printer is a Tektronix 340. A little archeological research dates them at 1996, 1992, and 1995, respectively. And how are they standing the test of time? The

LaserJet is functional and fast and prints cleanly. Newer versions are smaller and vastly less expensive, but this one will probably go forever. Ink jet printers have progressed so much in ink chemistry, droplet size, ink delivery, and droplet placement that printing with a three-year-old ink jet is like trying to do surgery with a butter knife sharpened on a rock.

The Tektronix 340, even though it's a couple of generations old, is still a phenomenal printer. It uses solid-color, waxlike stick ink, which it melts internally and applies to the page. The result is a thick, tactile print that looks almost silk-screened. The ink is translucent, so it makes great overheads. I've even printed on 0.005-inch aluminum sheet metal, which makes spectacular plaques. But the 340 goes through half a stick of (expensive) ink each time you power it on as it cleans and purges itself. You can leave it in standby mode, but then it's yet another device sucking down electricity.

Into this mix came an impassioned plea from my daughter, in her first year (heck, her first week) of college, for a color printer. She'd gotten her shiny new Gateway Profile computer all set up on the campus LAN and could print to the dorm's laser printer, but she realized she would need color and wanted backup in case the laser was busy or broken or the LAN was down.

I had a fleeting notion of pushing the Epson off on my daughter, but guilt quickly quashed that idea. I did a little research and decided on an HP 882C, a combo parallel and USB printer with decent speed and excellent color, even on plain paper.

The local computer store had reps from Hewlett-Packard and Canon in-store to help handle the back-to-school rush. After I'd selected the printer and picked up a cheap parallel cable (I don't fully trust USB), I asked the HP rep for help in finding the right replacement ink cartridges. He spied the parallel cable and told me that HP wouldn't guarantee the performance of the printer with that cable, then added that I needed one that conformed to the

IEEE1284 (Enhanced Printer Port) spec. I slunk back to the wall, rehung the \$7 cable and picked up a \$17 cable, only to have him tell me that it, too, was subpar. The IEEE1284 cable was \$40, a shock to me and my wallet.

I installed and tested the printer on one of my own systems when I got it home. Parallel installation was uneventful. USB installation seemed to go well, but the printer refused to print a bitmap. I went back into the printer setup and driver pages and printed the standard Windows test page, which worked fine. After that it printed the bitmap without any further fuss—typical USB weirdness.

Then I got to thinking about that printer cable. Did I really need this premium-priced cable, or was this just another way for cable manufacturers to line their pockets? I substituted an old 6-foot cable I'd found in the basement. It worked fine. I rummaged around some more and found a 10-foot printer cable, unshielded, but nicely made. The printer started spewing garbage. I switched back to the IEEE1284 cable, and everything was wonderful again.

The parallel port has changed dramatically since the last time I bought a printer. The current Enhanced Parallel Port started shipping in 1997 and can hit a megabit per second. Shielded, low-capacitance cable has become a must for new printers. Old warhorses, such as my current collection of printers, work well but slowly with the new ports because they fall back to traditional speeds and handshaking.

Since even a mundane cable can trip up your printer, you can see why the industry wants to move to USB. But it's still a rocky road. I got an e-mail the other day from a reader who had attempted to install the same HP 882C printer on his desktop system with USB. Neither he nor HP tech support could get it to work, although it worked well with his laptop's USB port.

Flaky USB behavior persists, despite dramatic improvements in Windows 98 SE. Until it gets better, I guess we'll have to continue to tolerate cables that cost \$6 per foot. **PC**



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The Future Is DOOMed

What will drive the next generation of PC applications? It has to be a combination of processor power, 3-D capability, and hard disk size. Is there any way to figure out where this will take us? I think so. Let's start by looking at games.

The most overlooked aspect of the computer market has always been

gaming. Games have pushed us to faster processors, MMX, CD-ROMs, and now 3-D. Faster processors, CD-ROM loading, memory-mapped displays, and color have all come from the game world. Eventually, business applications benefit. The fact is, we'd all be using terminals if it weren't for games.

Ever since the announcement of AMD's 3-D chip a couple of Comdexes ago, I've been asking chip makers the same question: "What are you going to use 3-D for in a business application?" To date, nobody has answered. The games themselves give us the answer, but no company has even attempted to implement 3-D file management.

Let's start with current game implementation. The classic shoot-'em-up is now based on the DOOM scenario, in which the user is roaming through a complex maze from room to room and shooting up the place. 3-D chips make the walls smoother and the action more defined. So well defined that there's no reason why they can't be the rooms of a large corporation or library where people browse the shelves. This kind of file system, a 3-D structure, has been discussed for years and was even featured in the film *Tron*. *Tron* may have also killed the notion, since the idea is now associated with a less-than-successful and somewhat corny movie. But the concept is great.

When you browse the Web through hyperlinks, there's no sense of time or space. In fact, Web surfing is a lot like going through a stack of magazines looking randomly at articles with dog-eared pages. It's all content and no experience. Anyone who has been in the stacks of a large university library knows that the process of going into the stacks to find your book is deeper than Web surfing.

At a library, in the process of scanning for the book you want, you may see books nearby that catch your attention. On the Web, you see links, but it's the same as seeing a book in the card catalog: raw data, the title, or maybe an annotation. But when you see a book on the shelf, it tells you other things. You can tell the age of the book by the binding and typography. You can tell the breadth by its thickness. You

can see multiple volumes. It is possible to add this dimension to our computing experience, and this must be the direction of things to come.

The computer desktop we use today has become messier and gaudier, with its backgrounds and screen savers, but it still represents a real-life desk and real folders into which we put paper. This model worked in the early days when there wasn't enough disk space to save much more than a few spreadsheets and word processing documents. The folders made sense then; now folders are complicated subdirectories with folders inside of folders inside of folders. It's ridiculous as a metaphor or model. Who puts folders inside of folders inside of folders? A kid or a madman, that's who. This concept is in serious need of revision.

Microsoft made a lame but sincere attempt to revise the model when it rolled out Microsoft Bob some years ago. Because the company was ridiculed and rebuked for Bob, it backed off completely from trying to change the model of the user interface. Microsoft now waits for Apple to do something it can copy. But the idea originally came from Xerox, and Xerox researchers seem to have lost interest in designing any more advanced computers. To make the next leap in computing, the entire user interface model must change. It's currently a dead end. We have the processing power to do something different.

Microsoft has to lament the death of Bob, but Bill Gates must shake his head even more over the failure of the CD-ROM content world. The Web wiped it out for a variety of reasons, but not because of user interface ingenuity. All the most interesting development in UI was done on CD-ROMs. Program after program had incredible user interfaces that only hint at what we may someday see on the desktop.

Exactly how this is going to emerge remains a mystery. Microsoft's proposed changes to the UI (Neptune or Consumer Windows) seem to be toward more simple Web-type brain-dead point-and-click lists. This is not the future. A clue to the future will be found on old CD-ROMs combined with new 3-D chips and game concepts. It's lurking.

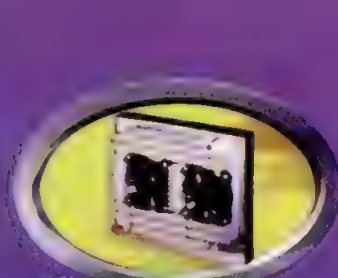


To make the next leap in computing, the entire UI model must change. We have the processing power to do something different.

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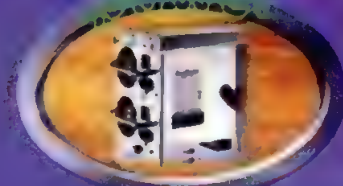
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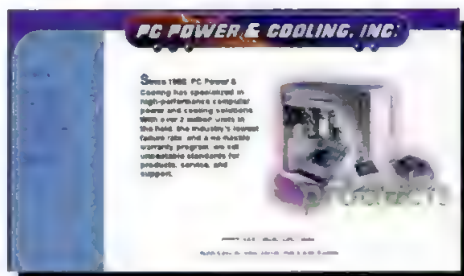
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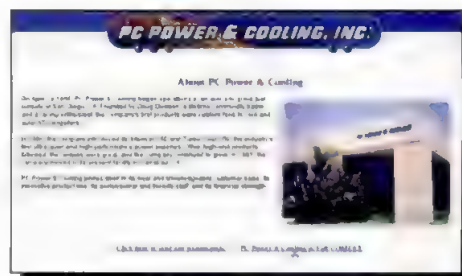
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A black and white photograph of actress Michelle Pfeiffer and a young girl. Michelle is in the foreground, looking towards the camera with a slight smile, her hand near her chin. The girl is behind her, also smiling. The text 'What excites Michelle?' is overlaid on the lower left of the image.

What excites Michelle?

Michelle Pfeiffer gets a thrill from a child's first smile, first steps and first words. She also knows it's essential to interact with children by talking, singing, reading or simply hugging—especially during the crucial first three years, when their brains grow to 90% of their adult size. That's why Michelle supports "I Am Your Child," an initiative providing important child development information to parents and caregivers. Which is exactly what you'll find at firstyears.excite.com—a resource for those who are looking for critical facts and guidance on child development. What's more, when you personalize your Excite start page at www.excite.com, Excite will donate \$2 to "I Am Your Child"—which should excite anyone who cares about kids.



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Jim Seymour

display and a great keyboard with the right-size keys in the right places—and, hallelujah, I've been getting more than 3 hours' worth of battery life. Bliss!

Most of the machines in this category forgo built-in floppy disk and CD-ROM/DVD-ROM drives. Dell, for example, adds them through a cheesy little external sleeve (ahem, the Dell Latitude External Media Bay) that hot-plugs and accepts CD-ROM, 3.5-inch floppy disk, LS-120, and Zip drives and links to the machine's internal IDE bus through a short cable. IBM adds them to the ThinkPad 570 through a thin, notebook-size horizontal "slice" (the UltraBay) that attaches to the bottom of the unit and ruins its easy portability. But I no longer worry much about those kinds of drives on the road. At my desk, I find the Dell and IBM solutions equally clumsy but workable.

If having a floppy disk drive and constant access to a CD-ROM drive is a Big Deal for you, none of these machines are likely to make you happy. I transfer files far more often over the Net, via LapLink's USB cable, or on my LAN than via floppy disks, and I use CDs as installation tools, not as everyday resources. So for me, losing the bulk and weight of these drives is an advantage, not a burden.

The one negative I've found to the thin 'n' wide boxes, including the Dell and IBM entries, is that they're a bear to use on the fold-down table in an airplane's coach section, especially when my friend in the row ahead mashes his seat back all the way. That also doesn't bug me, though, because I've tried to get away from working on flights—when I'm on the road, I need a respite from work, and long airborne naps are a particular delight for me—and because when I do need to work, I pile a couple of pillows on my lap and perch the notebook atop them.

This Dell machine I've been using isn't Valhalla. But it's currently the prime example of a great idea, an important inflection in notebook design. Large enough to be a real business tool, small and light enough to be easily portable, it defines the thin 'n' wide category. And I'll bet that if you get your hands on one, you won't let go. 

We Want It All

The problem is simple and not unique: I want a fast connection to the outside world via cable modem or DSL, and I want to share the connection over the network. If you're a multi-PC household, you may have the same interest; ditto if you're a small business or the regional office of a big business. Problem is,

the cable modem/DSL box needs to hook to your PC via the Ethernet card connection. And so does the network connection. You may have one Ethernet adapter in your PC if you're at home, and you certainly have one if you're in business, but what are the odds that your PC has *two* Ethernet adapters?

Here are some thoughts on how to juggle both the fast connections and the shared connections. It's a two-steps-forward, one-step-back process. Security is a big issue, because if you do it wrong, the rest of the Internet has access to your hard disk.

Assume that you've decided to kick your Internet connection into high gear with either a cable modem connection from the cable company or a DSL connection from the phone company. Assume also that you already have a simple Windows-based network up and running, with a handful of PCs and an Ethernet hub or switch. (For a tutorial on networking, see Solutions, "Home Network Setup," August, page 247.) Here are some ways you might make both work.

One-at-a-time connections. When you want to go online, you unplug one PC's network cable, then plug the cable modem or DSL cable into the PC's network card. Only one PC has high-speed access, and you can't network and access simultaneously, but this works in a pinch.

Rhythm-method sharing. You get an RJ-45 crossover cable (the transmit and receive pins are crossed) and with that, plug your cable modem/DSL box into the network hub. Your PCs see the Internet, which is good. But everyone on the Internet sees you and could hack into your computer. This is definitely not good. The more you do it, the more likely you're going to get in trouble.

Software-based sharing. You're still connecting the cable modem/DSL box into a hub, but now you have proxy-sharing software that protects your PCs from the outside world: WinProxy (see First Looks in this issue for a review), WinGate 3.0 Home (reviewed in First Looks, March 9, page 76), and many others. Microsoft has put proxy software into Windows 98 Second Edition and has slated it for inclu-

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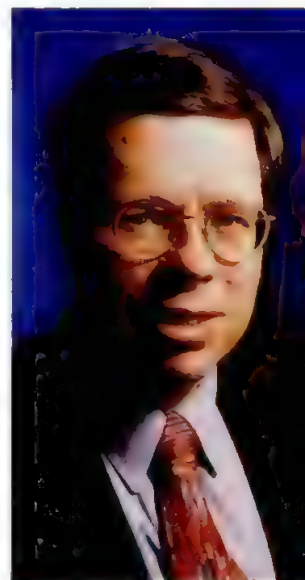
Two Ethernet cards. You can buy and install a second Ethernet card—the first connected to the network hub, the second to the high-speed connection—then add proxy-sharing software for safety. You may find fewer hassles using two identical cards.

Dual-port Ethernet card. If you're tight on slots, get a single Ethernet card that has two ports, from a vendor such as Adaptec or 3Com. Expect to pay \$200-plus, since it isn't a high-volume item.

USB. Get a USB-to-Ethernet adapter (\$50 to \$100) from Belkin, D-Link, Entega, or Linksys, and use that instead of a second Ethernet card. Soon we'll see USB-equipped cable modems. And solutions arriving near the end of the year include DSL and cable modems with links into wireless LANs and directly to USB.

Hardware proxy server/router. Such devices go by multiple names (Internet proxy server, router, access server, and so on), cost the most, and deliver the most: a router, IP sharing, and a firewall. For \$400 to \$750, you can buy a box that looks like a modem and has two Ethernet ports, from Bay Networks (the Instant Internet, www.nortelnetworks.com/solutions/smb), Beadle Networks (the SOHO 2000, www.beadlenet.com), MultiTech (the Dual-Ethernet Proxy Server, www.multitech.com), or Sonic Systems (the Sonic Wall, www.sonic.com). Linksys is expected to have one shortly.

With any of these solutions, you could be up and running in half an hour—or it might take days, depending on the interaction among the software, the PC, any extra hardware you're using, and the service provider. In some cases, you're technically obligated to tell your service provider if you're connecting more than a single PC, but many of the solutions here do a good job of masking that and showing just a single IP address to the outside world. Let your conscience be your guide. **PC**



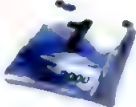
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Measuring influence and charting leadership in the personal computing industry are like forecasting the tides.  Scientific calculations are for the most part reliable, but unpredictable variations in temperature and wind direction can produce sudden and unexpected erosion.  In personal computing, the final months of the millennium find established companies scrambling for higher ground in the face of the growing Internet surge and the rise of the "dot-com" economy. 

most Influential Companies

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most Influential Companies

When we started developing this year's list of the 100 most influential companies in personal computing, we at *PC Magazine* knew our most important challenge was to account for the effects of the Internet, the undeniable force that has shaped this industry for the last three years. Longtime leaders Microsoft, Intel, IBM, Compaq, and others have felt their positions shift under that force. The extent to which they have survived at the top tier of our list reflects each one's ability to adapt to the Internet, not an ability to withstand it.

As in prior years, our list is the result of several months of debate among dozens of key staffers and contributing editors. We start by considering such factors as revenues, market share, profitability, and product performance, but the final rankings are as subjective as they are scientific. The discussions, carried out in the hallways, through e-mail, and inside a Lotus Notes database, were, as the diplomats say, "a frank exchange of views."

Our main area of agreement in the process was our conviction that the Internet economy is ushering in the new millennium. Success in this new era will come to those companies that are the most effective at producing the hardware, software, and networking infrastructure products and services that get people online at work and at home and make them more productive in both environments.

Beyond our certainty that the Internet changes everything, the only conclusion we could all agree on was that Microsoft is still the most influential presence in this business. Not Netscape, Sun Microsystems, America Online, nor even the Department of Justice has been able to dethrone Microsoft, by our estimation. Indeed, their efforts have served merely to show Microsoft's continuing dominance. No company can vie for supremacy in any key market of this business without crafting a careful and effective "Microsoft strategy."

Microsoft continues to be as influential with corporate IT buyers and the leading PC makers as ever. The company may indeed face significant challenges from AOL and various Linux vendors, but for today, at least, its dominance is undiminished. And Microsoft's ability to adapt to the Internet has kept it at least even in the battle to conquer the all-important new, online markets.

Beyond Redmond, however, the familiar patterns of the personal computing industry have changed dramatically as a result of the Internet.

This year's list reflects that, most notably in our conclusion that AOL has supplanted Intel as the second most important mover and shaker. Almost as remarkable, we decided that Amazon.com's and Yahoo!'s online leadership were so important that they belong in the top ten. These three Internet players hold the market positions and influence to which all other online companies aspire.

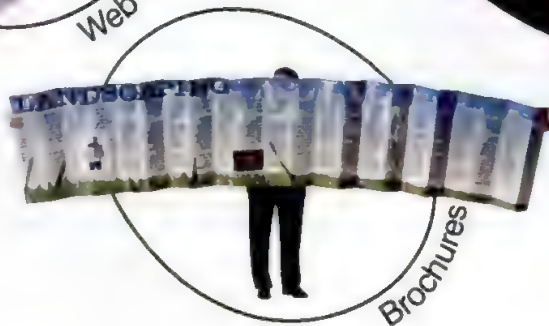
Continuing along that Internet front, most of this year's newcomers made the list on the strength of their online success, including eBay, which shows up for the first time at a remarkable sixteenth place, and E*Trade, priceline.com, Ink-tomi, Blue Mountain Arts, and MP3.com. A number of the more established members of this elite 100 listing also benefit from their work in online markets: Cisco, RealNetworks, AT&T, and Excite@Home, to mention a few. At the same time, old-line players such as Hewlett-Packard and Compaq are seeing their positions erode as they struggle to deploy online strategies to shore up their market outlook.

Long range, the industry forecast is for more unsettled weather. The Internet will be the dominant pattern, but Y2K squalls and antitrust outbreaks may well help shape next year's list. So will your reaction to this year's effort. We look forward to your comments.

—Jake Kirchner

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List



The biggest changes in this year's list of the most influential companies can be traced to one thing: the Internet. In many cases, even companies firmly entrenched in the analog world  have earned their places on the strength of their Internet strategies. Giants like Disney and General Electric can thank their online alter egos, GO Network and MSNBC, for their spots this year. And some old-school favorites, like HP and Seagate, have simply been elbowed down by the likes of AOL and eBay.

Of the 25 companies that didn't make it back this year, 10 can blame mergers or acquisitions. The others just couldn't keep the pace in Internet time. And of the debuts that took their places, almost half  wouldn't exist without the Internet.

24	~	Walt Disney (DIS) Burbank, CA www.disney.com	\$22,976.0	2.2%	\$1,850.0	Not available	It's a small world? Not when ABC, ESPN, and the Disney marketing machine join to provide quality content and endless shopping, while the Go.com portal gets constant on-air promotion.
25	40	Computer Associates (CA) Islandia, NY www.cal.com	\$5,253.0	11.3%	\$626.0	8.1%	CA is the world's number-three independent software company. New technologies and a persistent appetite for acquisitions keep it in the headlines
26	18	Toshiba (not traded in U.S.) Tokyo, Japan www.toshiba.com	\$41,352.3**	-6.0%	\$55.6	5.9%	A notebook sales champion and component supplier, Toshiba is trying to build its U.S. desktop and server businesses, and its consumer electronics business is positioned to take on convergence.
27	41	AMD (AMD) Sunnyvale, CA www.amd.com	\$2,542.1	7.9%	-\$104.0	22.3%	AMD's K6-2 captured significant retail market share, but AMD has been plagued with profitability problems. Its new Athlon chip, the fastest CPU on the market, may help.
28	34	Network Associates (NETA) Santa Clara, CA www.networkassociates.com	\$990.0	64.8%	\$36.4	13.7%	There's never a shortage of viruses that need vanquishing, and the encryption software business should also prove lucrative for Network Associates in the foreseeable future.
29	22	Softbank/Ziff-Davis (ZD) Tokyo, Japan www.softbank.co.jp , www.zdnet.com	\$4,381.2	12.7%	\$311.4	Not available	This software distributor owns upwards of 60 percent of Ziff-Davis (publisher of PC Magazine). It also has stakes in more than 50 Internet companies, including E*Trade, Yahoo!, and ZDNet
30	20	Intuit (INTU) Mountain View, CA www.intuit.com	\$592.7	-1.0%	-\$12.2	18.3%	Intuit is trying to recast itself as more than just the maker of Quicken and TurboTax, but its dominance of the personal-finance software market is jeopardized by threats from Microsoft.
31	97	Excite@Home (ATHM) Redwood City, CA www.home.net	\$48.0	548.6%	-\$144.2	35.4%	Broadband services @Home and @Work are poised to explode, and when they arrive at your house, the first thing you'll see is the Excite portal jazzed up with cool multimedia content.
32	~	Nortel Networks (NT) Brampton, Ontario, Canada www.nortel.com	\$17,575.0	13.8%	-\$537.0	14.0%	By purchasing Bay Networks (last year's number 26), Nortel makes the top half of our list. It's in dozens of areas and working hard to take advantage of the synergy in voice, data, VPN, and LAN.
33	28	Symantec (SYMC) Cupertino, CA www.symantec.com	\$592.6	11.2%	\$50.2	17.1%	In a dead heat for number-one in the software security market, Symantec makes the popular Norton antivirus and utilities software. Its new CEO is working to give it new direction.
34	23	Canon (CANNY) Tokyo, Japan www.canon.com	\$24,364.4	14.7%	\$944.6	6.3%	A new flat-panel display demonstrates the innovation that keeps this top imaging product manufacturer ahead of the pack, especially in the color arena.
35	21	NEC/Packard Bell NEC (NIPNY) Tokyo, Japan www.nec.com , www.packardbell.com	\$40,334.0	9.5%	-\$1,339.0	7.3%	Despite its acquisition of Packard Bell, NEC is struggling in the notebook and PC game. Though hurt by Japan's economic turmoil, it's still a leader in monitors, LCD projectors, and components
36	66	MCI WorldCom (WCOM) Washington, DC www.mciworldcom.com	\$17,678.0	139.4%	-\$2,669.0	21.1%	The second-largest U.S. long-distance carrier, MCI WorldCom is well positioned to excel in the Internet era. It invested deeply in the Internet—from backbone to Web hosting to end-user dial-up.
37	32	Seagate (SEG) Scotts Valley, CA www.seagate.com	\$6,819.0	-23.7%	-\$530.0	11.8%	A leader in disk drive technology, tape storage, and storage management software, Seagate is still the primary provider of the fastest SCSI disks for the workstation and server markets.
38	~	CNET (CNET) San Francisco, CA www.cnet.com	\$56.4	67.9%	\$2.6	6.2%	CNET is one of the few high-tech opinion leaders, with 1.6 million weekly visitors and millions more who see its syndicated TV shows. Part ownership of Snap.com gives it a portal play.
39	~	Mattel (MAT) El Segundo, CA www.mattel.com	\$4,781.9	-1.1%	\$332.3	3.7%	Computers aren't just for grown-ups anymore. Mattel Media is churning out PCs and digital cameras and has partnered with Intel for more. Acquisitions make it a player in consumer software.
40	29	Silicon Graphics (SGI) Mountain View, CA www.sgi.com	\$3,100.6	-15.3%	-\$459.6	14.8%	Clinging to its stature as the leader in high-end computing, SGI has redesigned operations to include a strategic alliance with nVidia and the formation of a business unit for its Windows workstations.
41	30	Seiko Epson (private) Nagano-ken, Japan www.epson.com	\$6,314.7**	24.3%	\$87.5	Not available	This conglomerate manufactures computers, printers, watches, semiconductors, and LCDs, among other devices. Subsidiary Epson is the world's number-two printer maker.
42	35	Micron (MUEI) Nampa, ID www.micronpc.com	\$3,011.9**	-14.3%	-\$233.7	9.0%	Micron's memory operations could profit from the switch to Rambus on Pentium IIIs. As the number-three direct PC vendor, it's focusing on small and medium-size businesses and power users.
43	37	Creative Technology (CREAF) Singapore www.creatf.com	\$1,234.2	1.0%	\$134.8	3.4%	Creative Labs Sound Blaster products still rule the market. Creative is also a volume supplier of graphics boards, DVD and CD-RW upgrade kits, and portable digital audio players
44	36	Autodesk (ADSK) San Rafael, CA www.autodesk.com	\$740.2	19.9%	\$90.6	19.3%	AutoCAD still dominates the desktop in computer-aided design, and its recent reorganization aims to make the company more Internet-focused through the new Autodesk Ventures unit
45	38	GT Interactive (GTIS) New York, NY www.gtinteractive.com	\$572.3	7.8%	-\$70.8	13.4%	GT is the maker of the rapidly successful games DOOM and Duke Nukem. Its Humongous Entertainment partnered with Nickelodeon to bring the kids' favorite "Blues Clues" to CD-ROM.
46	~	Vivendi/Havas Interactive (not traded in U.S.) Paris, France www.vivendi.com	\$37,029.3	24.6%	\$1,307.7	Not available	This French conglomerate owns Havas, which in turn bought Cendant's software division (Sierra On-Line, Blizzard, and Knowledge Adventure), making Vivendi a bona fide player in the U.S.
47	52	Rambus (RMBS) Mountain View, CA www.rambus.com	\$37.9	45.8%	\$6.8	25.3%	Rambus designs high-bandwidth DRAM interfaces and protocols. Rambus memory enhances multimedia and streaming applications and will star in the latest and greatest PCs.
48	44	National Semiconductor (NSM) Santa Clara, CA www.national.com	\$2,536.7	-5.5%	-\$98.6	19.0%	A leader in analog and mixed-signal products, Nat Semi sold its Cynix subsidiary rather than competing head-on with Intel. It plans to focus on information appliances and analog businesses.
49	47	International Data Group (private) Boston, MA www.idg.com	\$2,350.0	14.6% ↑	Not available	Not available	IDG is a media empire focused solely on information technology. Its products range from 285 magazines and more than 500 book titles to computer market-research firm IDC.

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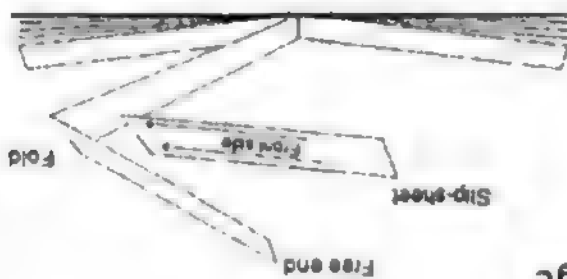


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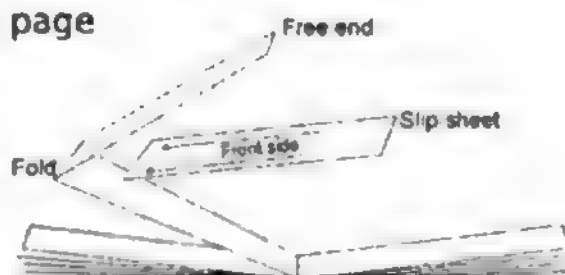
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4. Close the page and slip-sheet



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1999	1998	Company (stock symbol), location, URL	1998 revenues (millions)	Percent change from 1997	1998 net income (millions)	1998 R & D as percent of total revenues
1	1	Microsoft (MSFT) Redmond, WA www.microsoft.com	\$14,484.0	27.5%	\$4,490.0	17.3%
2	8	America Online (AOL) Dulles, VA www.aol.com	\$2,000.0	54.3%	\$82.0	8.7%
3	2	Intel (INTC) Santa Clara, CA www.intel.com	\$26,273.0	4.9%	\$8,068.0	9.5%
4	3	IBM (IBM) Armonk, NY www.ibm.com	\$81,667.0	4.0%	\$6,328.0	6.2%
5	6	Cisco Systems (CSCO) San Jose, CA www.cisco.com	\$8,458.8	31.3%	\$1,380.1	12.1%
6	33	Amazon.com (AMZN) Seattle, WA www.amazon.com	\$610.0	312.7%	-\$124.5	7.7%
7	13	Yahoo! (YHOO) Santa Clara, CA www.yahoo.com	\$203.3	188.4%	\$25.8	11.2%
8	11	Oracle (ORCL) Redwood Shores, CA www.oracle.com	\$7,143.9	25.7%	\$813.7	10.1%
9	9	Dell (DELL) Round Rock, TX www.dell.com	\$18,243.0	48.0%	\$1,460.0	1.5%
10	5	Hewlett-Packard (HWP) Palo Alto, CA www.hp.com	\$47,061.0	9.7%	\$2,945.0	7.1%
11	7	Sun (SUNW) Palo Alto, CA www.sun.com	\$9,790.8	13.9%	\$782.9	10.4%
12	4	Compaq (CPO) Houston, TX www.compaq.com	\$31,180.0	26.8%	-\$2,743.0	4.3%
13	12	3Com (COMS) Santa Clara, CA www.3com.com	\$5,420.4	-3.3%	\$30.2	10.7%
14	16	Apple (AAPL) Cupertino, CA www.apple.com	\$5,941.0	-18.1%	\$309.0	5.1%
15	24	RealNetworks (RHWK) Seattle, WA www.real.com	\$84.8	98.2%	-\$16.4	32.1%
16	~	eBay (EBAY) San Jose, CA www.ebay.com	\$47.4	724.4%	\$2.4	8.7%
17	45	AT&T (T) New York, NY www.att.com	\$53,223.0	3.2%	\$6,398.0	1.2%
18	25	Sony (SNE) Tokyo, Japan www.sony.com	\$56,821.8	10.6%	\$1,481.7	5.5%
19	15	Adobe (ADBE) San Jose, CA www.adobe.com	\$884.8	-1.9%	\$105.1	23.2%
20	19	Macromedia (MACR) San Francisco, CA www.macromedia.com	\$49.9	32.5%	\$19.8	23.7%
21	14	Gateway (GTW) North Sioux City, SD www.gateway.com	\$7,467.9	18.7%	\$348.4	1.0%
22	31	Lucent (LUC) Murray Hill, NJ www.lucant.com	\$30,147.0	14.4%	\$870.0	12.2%
23	~	Novell (NOVI)	\$1,083.9	7.8%	\$102.0	20.8%

\$1.1 trillion

is the total revenue of all the companies on the Top 100. They spent \$68 billion on research and development.

The combined gross national product of Argentina, Greece, Poland, and Sweden is \$943 billion.



If Linux were a company, it would land at about number 6.



Mergers & Acquisitions

America Online
(*)
acquired Netscape Communications.

Intel

The Redmond behemoth sets the agenda for personal computing. Just ask the Justice Department and the antitrust authorities in half the states and in other industrialized countries.

The numbers amaze: 15 million users, 800 million instant messages a day. AOL is the Net's easiest on-ramp and the only ISP that's a household name. This year the commerce side heats up. Chip competition is only making Intel run faster and compete harder. And its influence in PC design remains unchallenged (think chip sets, motherboards, graphics, and buses).

By far the biggest computer company in the world, IBM is still a technological innovator in component design and a leader in the industry's rush to services and online commerce.

A leader in network infrastructure, Cisco drives technical standards and product quality throughout the industry and is now spreading into the small and medium-size enterprise.

Profits may still be years away, but everybody—and we mean everybody—wants to be like this online retailer, which has expanded into auctions, gifts, toys, and electronics this year.

Do you Yahoo? Some 16 million visitors per week do. Its latest, the integration of Broadcast.com and GeoCities, international sites, and banking links. The juggernaut sails on.

The runaway leader in an increasingly database-dependent world, this software giant is also expanding aggressively into online commerce and services.

Dell's sales continue to skyrocket as it teaches every other PC maker painful lessons in online marketing, inventory management, service, and support.

Its alliance with Intel on IA-64 development and its IBM-like spectrum of products and patents position HP for further growth and continued influence across the entire computing horizon.

The graphics workstation market is migrating to WinTel, but Sun has plenty to keep it busy in the Internet space. Java still matters, and Sun's technologies power countless Web sites.

Organizational, financial, and market-share woes have only slightly tarnished Compaq's influence in corporate IT and consumer computing. Look for a roaring comeback.

Network infrastructure is 3Com's bread and butter, and it's making a push into the home market. But its Palm products keep it at the forefront of the hand-held market and in the public eye.

By adding some welcome verve to a design starved industry, Apple is coloring its perception among consumers and competitors as it struggles to regain its lost glory and market share.

RealJukebox has brought MP3 music to the masses, and this online audio pioneer is making nice with the record industry to be in on the action when we start buying songs online.

From humble beginnings, a cultural phenomenon has emerged. The world's largest flea market has spawned thousands of imitators and changed the way people think about shopping online.

As long distance heads toward 0 cents a minute, Ma Bell shifts gears, buys into cable TV, and makes a broadband play with Internet access. Success depends on overcoming outsourcing barriers.

The granddaddy of consumer electronics is turning heads with its VAIO PCs. Its foray into convergence promises to bring all the pieces of this electronics and entertainment giant together.

No longer the only game in town for desktop publishing tools, Adobe maintains its position on the strength of its Internet content creation tools, like Photoshop and ImageReady.

It's nice to own the name that's synonymous with Web graphics. Flash is ubiquitous, and Shockwave is still holding strong. Meanwhile, Dreamweaver is becoming a Web design standard.

In the world of direct vendors, Gateway plays feisty Anis to Dell's Hertz. Though it has little traction in big business sales, it has a solid presence in the home and small business markets.

Lucent's software and chips provide the smarts behind virtually every Internet broadband and telecommunications technology. Acquisitions will take Lucent deeper into WAN switching.

The second largest pure PC software company, Novell is still influential in networking. It can



HP NetServer LH 4: Intel® Pentium® III Xeon™ processor 450 MHz, 500 MHz / Up to four-way processing / 0 to 144 GB hot-swap hard drives
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An event is detected.

Failure attacks.

Reacting swiftly, our netserver analyzes the situation
and renders a paralyzing block to the bad sector.

Peace is restored.

The republic of your network remains intact.

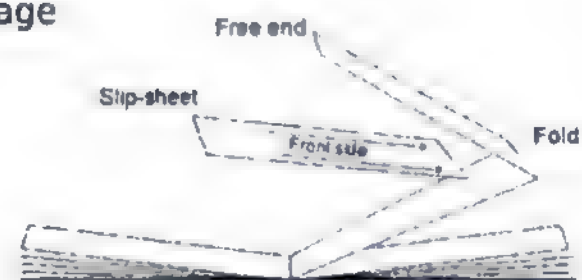
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Foldout slip-sheet



Inverted Foldout slip-sheet

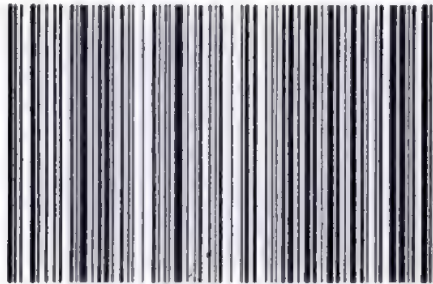
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Back

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IPOs

Of the IPOs on the PC Magazine Top 100 since January 1, 1998—

- Aironet,
 - Broadcom,
 - eBay,
 - InfoSpace.com,
 - Inktomi,
 - MP3.com,
 - nVidia, PC
 - Connection,
 - priceline.com,
 - Red Hat, and
 - Ziff-Davis
- half were Internet companies.
- The number of pure Internet companies on the Top 100 has almost doubled:
- Amazon.com,
 - AOL, CMGI,
 - CNET,
 - eBay, E*Trade,
 - Excite@Home,
 - InfoSpace.com,
 - Inktomi,

50	Xerox (XRX) Stamford, CT www.xerox.com	\$19,448.0	7.2%	\$385.0	5.4%	Its brand long synonymous with copiers, the Document Company is now making strides in the digital arena, with digital products accounting for nearly half of its sales.
51	Acer (not traded in U.S.) Taipei, Taiwan www.acer.com	\$2,980.0	24.5%	\$77.4	3.6%	Its funky purple PC may be losing ground here, but Acer is still a major presence in Asian markets.
52	Philips Electronics (PHG) Eindhoven, Netherlands www.philips.com	\$35,900.0	1.1%	\$8,738.0	8.7%	Philips's influence is growing as the worlds of computers and consumer electronics merge. A major supplier of components, it has also been a mover behind the CD and DVD standards.
53	Red Hat (RHAT) Durham, NC www.redhat.com	\$10.8	107.7%	-\$0.9	20.4%	This start-up, which packages Linux and sells it with tech support, launched a successful IPO during a down market, giving hope to Linux devotees everywhere.
54	Broadcom (BRCM) Irvine, CA www.broadcom.com	\$203.1	448.9%	\$38.4	18.9%	56K Internet connections? How about 10 million bps? It could be in homes soon if Broadcom's supercompression chips find their way into more modems and set-top boxes.
55	Time Warner (TWX) New York, NY www.timewarner.com	\$14,582.0	9.7%	\$168.0	Not available	Pathfinder proved to be a five-year-long nightmare, but its passing clears the decks for a new presentation of the company's invaluable brands, including CNN, EW, People, SI, and TIME.
56	Adaptec (ADPT) Milpitas, CA www.adaptec.com	\$692.4	-31.3%	-\$13.3	21.1%	Back from the brink, Adaptec still leads the market in SCSI adapter technology, but its influence is slipping.
57	Texas Instruments (TXN) Dallas, TX www.ti.com	\$8,460.0	-13.2%	\$407.0	14.3%	TI is betting the ranch on DSP technology. Its patience will be rewarded as the decade-old digital mirror device becomes the engine of choice in leading-edge LCD-style projectors.
58	Motorola (MOT) Schaumburg, IL www.motorola.com	\$29,388.0	-1.3%	-\$882.0	9.8%	Best known for its cell phones, pagers, and PowerPC processors, Motorola is battling Nokia in the telephone and thin terminal markets and moving into cable modems and DSL devices.
59	Matsushita/Panasonic (MC) Osaka, Japan www.mel.co.jp	\$63,668.0	6.5%	\$113.0	6.5%	Panasonic is a major supplier of monitors and PC components. With its savvy in computers, telephony, and consumer audio/video, it will be a major force in digital convergence.
60	E*Trade (EGRP) Menlo Park, CA www.etrade.com	\$245.3	56.8%	-\$0.7	13.4%	Keeping the day-trader phenomenon growing, E*Trade leads the way with more than 1 million active accounts. When's the last time you talked to your stockbroker?
61	Western Digital (WDC) Irvine, CA www.westerndigital.com	\$3,541.5	-15.2%	-\$280.2	5.8%	A stalwart supplier of mainstream PC hard disks, Western Digital also carries a line of SCSI drive products for enterprise use.
62	Sharp (not traded in U.S.) Osaka, Japan www.sharp-world.com	\$10,784.7	7.0%	\$24.1	10.0%	A leading manufacturer of home and office electronics, Sharp makes a variety of popular handheld PCs and consistently advances LCD technology.
63	InfoSpace.com (INSP) Redmond, WA www.infospace.com	\$9.4	458.8%	-\$9.1	8.4%	Ever look up a phone number or Yellow Pages listing online? Chances are, your search was powered by this ubiquitous provider of basic reference information.
64	Fujitsu (FJTSY) Tokyo, Japan www.fujitsu.com	\$43,330.0	14.7%	-\$113.0	7.5%	A global player producing everything from notebooks to mainframes, Fujitsu is small but tenacious in the U.S. with rugged tablets and notebooks.
65	General Electric/NBC (GE) Fairfield, CT www.ge.com	\$100,489.0	10.8%	\$9,288.0	1.9%	GE's NBC has been ahead of its broadcast rivals since the get-go with CNBC and MSNBC. Add Snap.com and it's positioned to compete with Disney/ABC and whatever CBS cooks up.
66	nVidia (NVDA) Santa Clara, CA www.nvidia.com	\$158.2	443.6%	\$4.1	15.9%	nVidia is the leading 2-D/3-D graphics chip supplier for professional and enthusiast PCs. Its latest technology incorporates 3-D transform and lighting engines—a first in mainstream PCs.
67	Hitachi (HIT) Tokyo, Japan www.hitachi.com	\$60,333.5	4.0%	\$2,800.0	6.2%	Its costly U.S. push for notebook, desktop, and server market share didn't pan out, but Hitachi is still a major international force in big-iron mainframes.
68	CMGI (CMGI) Andover, MA www.cmgi.com	\$91.5	29.6%	\$18.8	41.9%	This many-tenanted Internet investment firm buys stakes in up-and-coming companies, and its track record is stellar. It owns 20 percent of Lycos, and in June, CMGI picked up AltaVista.
69	ViewSonic (private) Walnut, CA www.viewsonic.com	\$941.1	13.8% ¹	Not available	Not available	ViewSonic is a key vendor of monitors, LCD monitors, and LCD projectors. Unlike many Taiwanese monitor companies, ViewSonic commands a premium price for its products.
70	Visio (VSIO) Seattle, WA www.visio.com	\$168.0	64.7%	\$28.1	18.4%	Maker of the de facto standard in Windows-based charting and diagramming software, Visio also has a stake in IT design and documentation tools.
71	Iomega (IOM) Roy, UT www.iomega.com	\$1,894.4	-2.6%	-\$54.2	6.0%	Amid fierce competition, Iomega is trying to keep its hold on the data storage market. The advent of inexpensive CD-RW's could mean bigger trouble for the Zip, Jaz, and Click! drive maker.
72	ATI Technologies (ATY) Thornhill, Canada www.atitech.com	\$737.3	91.8%	\$107.3	5.8%	ATI is the largest-volume supplier of PC and Mac graphics solutions. It's not the 3-D gaming performance leader, but the All-in-Wonder 128 graphics board has a great mix of features.
73	priceline.com (PCLN) Stamford, CT www.priceline.com	\$35.2	Not available	-\$112.2	31.5%	priceline.com is one of the few sites that have truly redefined what a market is in the Internet age. Others would like to copy the name-your-own-price model, but it holds the vital patents.
74	Inktomi (INKT) San Mateo, CA www.inktomi.com	\$20.4	251.7%	-\$22.4	58.8%	Invisible but everywhere, Inktomi is not just a leader in search-engine technology but also a hugely important shopping database, linking merchants to portals and e-commerce sites.
75	emachines (EEEE) Irvine, CA www.edme.com	\$70.0	[Founded 9/98]	-\$2.8	Not available	Take one savvy ex-retailer, add two parts Korean manufacturing, mix in plummeting component prices and a helping of Internet users and you've the recipe for supercheap e-machines.
76	Dragon Systems (private)	\$71.4	186.4%	\$10.3	20.4%	The technology is making strides, and if speech recognition software is the way of the future,



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Broadcom



Henry T. Nicholas III, Ph.D., CEO

Pumping Network Iron

For a moment, if only just a moment, a flash of confusion crosses the face of Henry T.

Nicholas III, Ph.D., chief executive of Broadcom Corp. The goateed, 6-foot 6-inch, 39-year-old bodybuilder is just finishing a cell phone call, and the earplug is still dangling from his ear. Outside the stretch limousine, Los Angeles rush-hour traffic thwarts the driver's attempt to get Nicholas to a 5:30 meeting. Just before his pocket rang, Nicholas had been balancing a laptop on one knee and thumbing through a paper flip chart to make a crucial point about his company's focus. Now, to regain his own focus, the one-time Air Force pilot hits a cell phone button noting, "I never do this, I never turn it off."

It is perhaps because of—or in spite of—the overload of digital and analog input that Nicholas and Broadcom share a joint mission: "To connect everyone, everywhere, anytime." And Broadcom just may be the company to do so. Broadcom has beaten nearly all comers with its ability to compress Internet, video, and voice data, so it can make its way to a television, PC, or wireless device at speeds 20 to 1,000 times as fast as a 56K modem.

Broadcom is often characterized as a "last-mile" communications company—one of many building the infrastructure to bring

high-speed Internet and other services directly to homes and offices. It is indeed that, but the last mile wouldn't be worth the walk if it weren't for Broadcom's products. Imagine a world where a system of pipes designed to carry water to every home and building could suddenly produce only enough pressure to send a slow drip-drip-drip to very thirsty customers. Now imagine there's a device that has to be installed in every faucet to turn that trickle into a torrent. Change water to data and, roughly speaking, Broadcom has that device.

Broadcom's compression technology has already found its way into a spate of diverse products, ranging from set-top boxes for the home from General Instrument and Philips, to cable modems from WebTV and 3Com, to local area network cards from Cisco and Intel. These technology companies, which helped Broadcom to \$203 million in 1998 revenue, aren't the only believers. Wall Street welcomed Broadcom's April 1998, \$12-a-share IPO by boosting the stock price to close to \$150 by the next July (although it had dropped to about \$120 by August 1999).

If investors are confused by Broadcom, well, even the CEO has a hard time categorizing the company, whose chips are in 1 million cable modems and 3 million set-top boxes. Broadcom is not an Internet company nor is it a chip company, Nicholas says. "We're no more a chip company than Microsoft is a disk company," he says, adding that chips are the medium through which Broadcom expresses its intellectual property. Indeed, the company doesn't own a chip-making facility and instead contracts out its designs to fabs run by other companies.

If it's not about chips or the Internet, what is it about? According to Nicholas, the day is almost upon us when AT&T and its cable acquisitions, local Bell operating companies, or plain, old cable companies will offer telephone, cable TV, and Internet service all through one little box that could sit either inside or outside the home. And whichever industry wins the last-mile race to deliver data, Broadcom chips are likely to power that little box. Once that happens, the PC, TV, and phone will never be the same, at least according to Nicholas.

In Nicholas's world, Internet sites and TV channels will become indistinguishable. Since voice and data will travel the same digital pathways, the big screen could also become a super Caller ID/answering machine that dials back callers via voice commands. The tube that now plays host to sporting events, sitcoms, and movies will become an always-on Internet terminal that provides a Web connection as easily as the telephone now delivers a dial tone. The technology is available today, Nicholas insists, and it will be commonplace in just three years if Broadcom's 500 employees can keep up the pace.

But as the limo nears the end of its frenetic journey, and Nicholas pushes back into plush leather to reflect on the road ahead, the driver passes his own cell phone to the man in a hurry. It's Nicholas's secretary calling with another urgent message that couldn't wait for the CEO's cell phone to come back on. The 5:30 meeting, it seems, has been canceled.—Jim Bartimo

INDUSTRY CLOSE-UP

Building the Networked Economy

The networking companies in our top 100 can take credit for more than your corporate LAN. In many cases,

the workings of the Internet owe a debt of gratitude to the likes of Cisco and 3Com. Without them, there'd be no eBay or Priceline.com. Networking may not be something you think about every day, but you probably use it at least that often.

The highest-rated networking company on our Top 100 lands at number 3: **Intel** is the gorilla of networking that seems to get real joy from stealing bananas from 3Com. Following a strategy of finding ways to keep processors busy, Intel has squashed profit margins in LAN adapters and print servers. The company pushed the USB standard, is promoting home and small-office networking with low-cost and easy-to-use products, and now is moving into the driver's seat in virtual private networks and firewalls. The direct benefit to you is lower cost to work from home, better and more affordable Internet access, and more flexibility in computing architecture.

Once practically the only networking company, **IBM** is no longer a leader or innovator but a supplier. IBM's mantle as an innovator has fallen to **Cisco**. Like the old IBM, and very much unlike Intel, Cisco isn't afraid to set its own technical standards outside the industry's cooperative process. Cisco goads standards committees into faster time to market for new technologies. Recently, Cisco's actions moved along the development of switches and routers that can manage the priority of specific packets. This development means desktop games, entertainment over the Internet, and video for training and productivity will become much more practical.

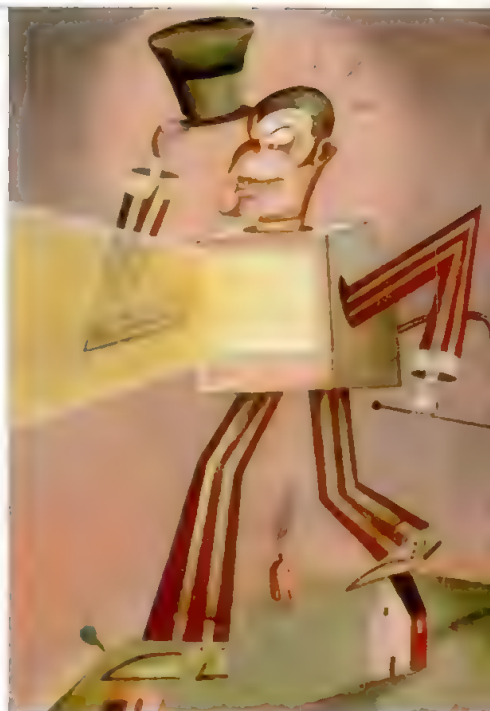
Hewlett-Packard uses the rare combination of high quality and aggressive pricing to drive the market. HP's products, particularly its hubs and switches, are always contenders in network acquisitions because of

price, quality, and unique HP services. HP has also been a leader in keeping down the overall cost of networking with standard-setting management software. If your ISP can afford to give you low-cost connection time or a free PC, say "Thanks!" to HP for driving down the costs of basic infrastructure products.

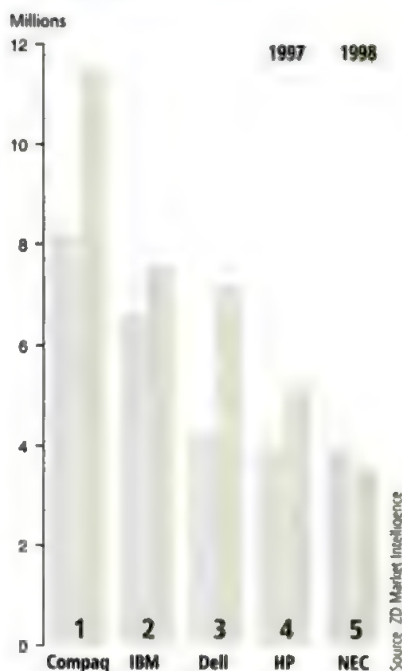
Much of the energy at **3Com** is going into three directions: cable modems, DSL, and wireless LAN products. In each area, 3Com has invested in R & D, contributed resources to international committees, created new channels, and developed interoperable products. In many cases, 3Com's actions helped future competitors develop interoperable products, but that's how you build a market. The goal at 3Com is fast and flexible ubiquitous connectivity.

D-Link and **Linksys**, along with **Nortel/Bay Networks**, are filling the retail channel with affordable prepackaged networking products. Each company has dozens of hub, adapter, and router products on store shelves. Thanks to them, buyers can expect that when they remove the shrink-wrap and plug the product in, the thing will work. That kind of simplicity and reliability isn't easy to achieve in consumer networking products, but it's critical to making network connections as common as air.

Leading the industry in outsourcing network services are **AT&T** and **MCI WorldCom**. If your business is selling frozen foods, why should you hire or train an expert in networking? AT&T and MCI WorldCom are in the business of networking, and they'll rent you their expertise and resources. When you break the hire-train-hire cycle in the computer room, plug a security hole, or cure Y2K problems, you've probably done it with outsourced help.—*Frank J. Derfler, Jr.*



Worldwide PC Unit Sales



ILLUSTRATIONS BY JACQUES COURNOYER (TOP), POLLY BECKER (BOTTOM)

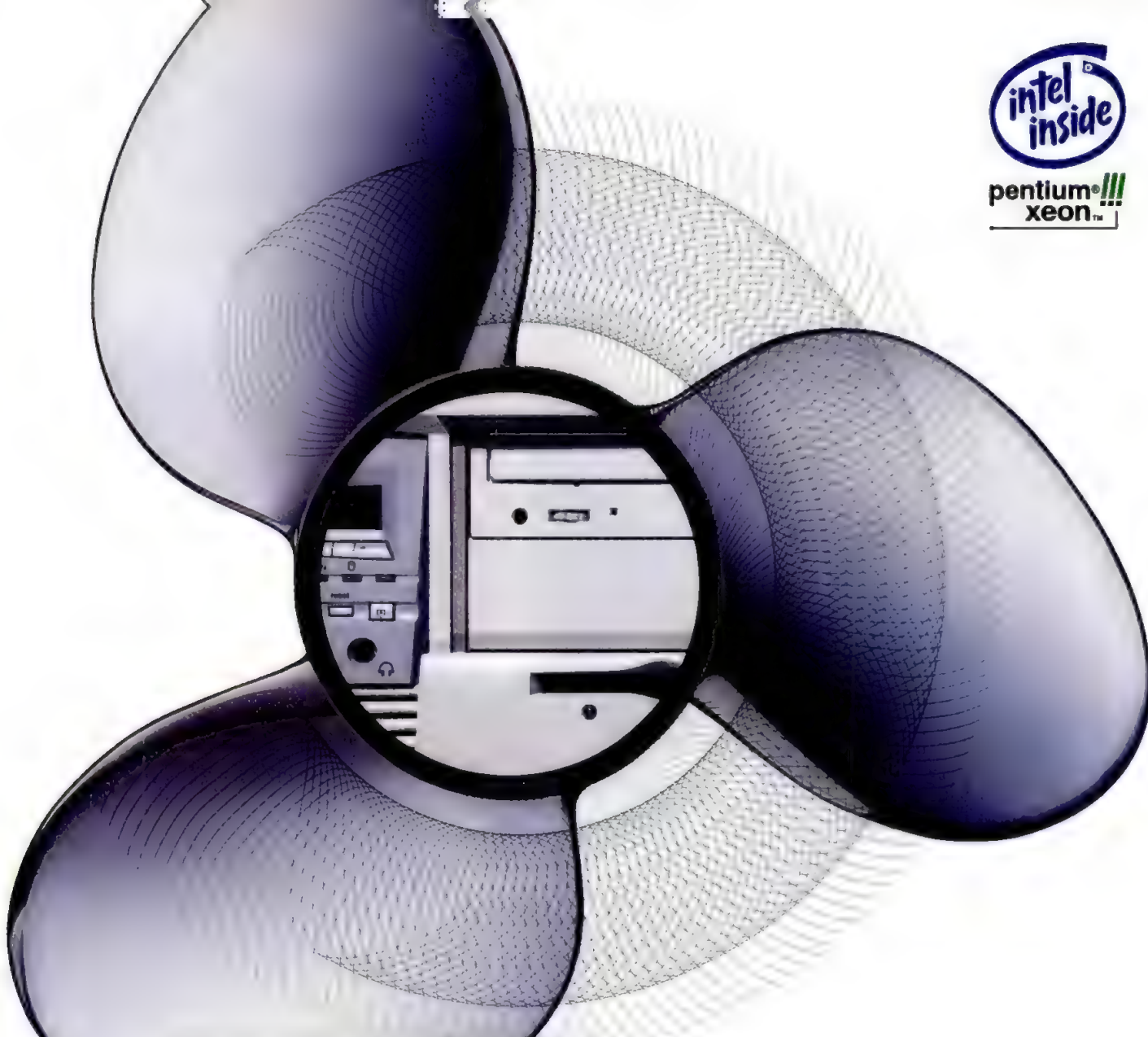


Auspicious Top 100 Debuts:

eBay
16

Walt Disney
24

Nortel Networks
32



Water displaced creates forward thrust.
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and *can't do that* are left
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DEBUT AT 100 FOUNDED: 1994. NUMBER OF EMPLOYEES: 100. HEADQUARTERS: OREM, UTAH. CALDERA WAS A START-UP VENTURE FUNDED BY

Caldera



Bryan Sparks, founder

Fighting the Linux Fight

In 1994, when Bryan Sparks founded Caldera to sell a version of Unix called

OpenLinux, it seemed as if Unix would always be the OS of the future—never of the present. These days, Sparks isn't the only one taking Linux seriously. Competitor Red Hat, which also offers Linux, made its initial public offering in August and saw its shares rise by 500 percent in three days.

But Caldera itself has grown to a multifaceted Linux provider. The Orem, Utah, company's subsidiary, Caldera Systems, handles OpenLinux sales for PCs and servers. Its new division, Lineo, headed by Sparks, offers a scaled-down embedded Linux for such things as set-top boxes and hand-held devices.

So what makes Linux different from always-a-bridesmaid-never-a-bride Unix? Linux is a standardized version of Unix, which was designed to run on just about any kind of computer, big or small. But decades of rapid-fire change in the computer industry and, some say, a refusal by free-thinking Unix mavens to conform, created dozens of incompatible permutations.

But with Linux, all improvements must be submitted to a standards organization, leaving companies such as Caldera Systems and Red Hat to offer software applications and support to Linux

users. "Unix was open so that anybody could make improvements to it," Sparks says, "but this time around, people finally decided that all these versions were keeping it from catching on."

Few expect Linux to displace Windows any time soon, but the OS of the future has found a robust market in today's Internet servers. Caldera boasts years of network experience; many of its employees were culled from Novell, which developed the NetWare OS found on many business networks. And both Caldera Systems and Lineo are holdings of the Canopy Group Investment Company, which was created by former Novell CEO Ray Noorda.

Sparks is mounting his own battle against Microsoft. Lineo's Embrowser, for one, challenges Microsoft's WebTV acquisition by running an Internet browser on a stripped-down Linux in the cramped quarters of a set-top box. Lineo has already inked one partnership deal with Motorola, and Sparks hints that several more are waiting in the wings. "We could end up putting a browser on your refrigerator," he says. "I know my wife would love that, because she uses the Internet to look up recipes."

Lineo's 1996 purchase of a DOS clone called DR-DOS also poses a challenge to Microsoft on two fronts. First, DR-DOS is a low-overhead alternative to Windows CE, and second, it already has an installed base that Sparks says could end up funding his Linux development. Lineo is also pursuing a lawsuit that came with the DR-DOS purchase from Novell, which claims the Redmond giant broke antitrust laws to dominate the DOS and Windows markets. "We could make a lot of money in our legal battle," Sparks said. "But I prefer people focus on the \$10 million we expect to make in the next 12 months on embedded products."

Despite the mellow Utah backdrop, Microsoft anger runs deep in these parts. After all, many software executives here saw Corel WordPerfect's market share usurped as Microsoft Word dominated the Windows environment. NetWare now seems to face the same challenge from Microsoft NT and other server products. Sparks, for instance, gets a big kick out of showing visitors his handbook of Microsoft ethics that turns out to be all blank pages.

Meanwhile, Caldera Systems provides desktop and server versions of Linux, along with support to its network of 700 value-added resellers and corporate users. That support includes Linux systems administration training and certification courses through Caldera Systems Education Services and Caldera Authorized Training Centers around the globe. Caldera Systems CEO Ransom H. Love has long years of networking experience, finishing up his tenure at Novell as senior product manager, working with NetWare for Unix, and negotiating pivotal partnership with such other Unix-savvy companies as Hewlett-Packard, Sun Microsystems, and IBM.

Whether Caldera Systems or Lineo will succeed in the long term by offering add-ons, support, and embedded applications for Linux is still a big question mark. But if neither succeeds, well, there's always the future.—JB



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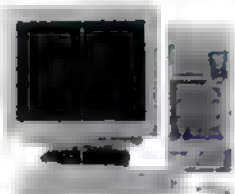
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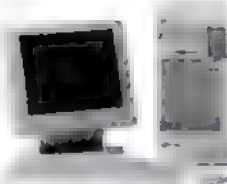
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ELSA GLoria Synergy+
graphics card
32x CD-ROM
Windows NT 4.0
HP 10/100 PCI NIC
Dual SCSI controllers
TopTools manageability:
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HP 10/100 PCI NIC
TopTools manageability:
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AccelGALAXY
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Windows NT 4.0
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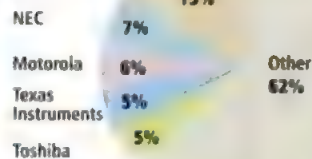
What Makes the Big Sites Run?

We asked some of the most trafficked Web properties to divulge their hardware and software platforms. Although every site is using a different mix of products, Sun's name crops up frequently in both the OS and hardware categories, lending credence to its claim that it "powers the dot-com enterprise." And more than half the sites use the free Web server Apache, a sign of how much impact the open-source movement has had on Web infrastructure.

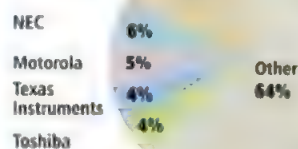
	Operating system	Database	Hardware	Web server	Search engine
About.com www.about.com	FreeBSD, Microsoft Windows NT, Solaris	Microsoft SQL Server, Oracle	Compaq, HP, Sun, Telenet	Apache, Microsoft IIS	Thunderstone
Amazon.com www.amazon.com	Unix	Oracle	Intel-based Compaq systems	Apache, Netscape Enterprise	Alta Vista
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GO Network www.go.com	Microsoft Windows NT, Solaris	Microsoft SQL Server, Oracle	HP, Sun	Microsoft IIS, Netscape, proprietary	Infoseek
Go2Net Network www.go2net.com	BSDi, FreeBSD, Linux, Microsoft Windows NT, Solaris	MySQL, Oracle, Sybase, proprietary	Dell, Intel-based systems, Sun	Apache	MetaCrawler
Juno www.juno.com	Solaris	Oracle, Portal, Sybase	Sun	Apache, Netscape Enterprise	Lycos
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Xoom.com sites www.xoom.com	FreeBSD, Linux, Solaris	MySQL, Oracle	Intel-based systems, Sun, Sun clones	Apache, Boa	Autonomy
Yahoo! sites www.yahoo.com	FreeBSD	Oracle	Intel-based systems	Apache	Yahoo!
ZDNet sites www.zdnet.com	Solaris	Oracle	Sun	Apache, Netscape Enterprise	Thunderstone

Semiconductor Market Share

1997 revenue (millions):
\$147,165

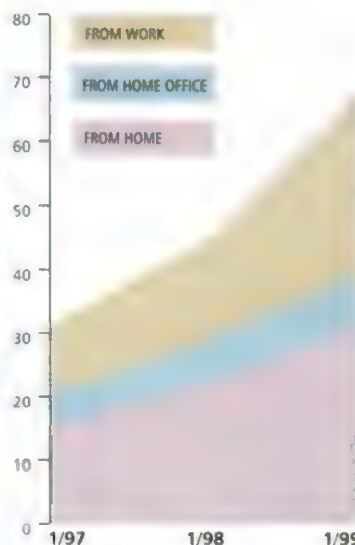


1998 revenue (millions):
\$136,158



Source: Dataquest

PCs Connecting to The Internet



Source: ZD InfoStat

Biggest Jump, Biggest Drop

Companies that had the greatest rise in rank:

Excite@Home

97 to 31

MCI WorldCom

66 to 36

And the greatest fall:

Corel

27 to 95

MetaCreations

58 to 87



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- 40X Max⁵ Variable CD-ROM
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- 3-Year Limited Warranty²
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\$3579

Business Lease¹⁵: \$120/Mo., 36 Mos.

 **E-VALUE CODE: 04170-890935**

DELL INSPIRON 7000

Mobile Desktop

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- 15" XGA Active Matrix Display
- 32MB SDRAM
- 4.8GB⁴ Ultra ATA Hard Drive
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- 3D Surround Sound with Wavetable
- Lithium Ion Battery
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\$1999

Business Lease¹⁵: \$67/Mo., 36 Mos.

 **E-VALUE CODE: 04170-890919**

DELL INSPIRON 3500

Light Weight, Light Price

- Pentium II Processor at 366MHz
- 14.1" XGA Active Matrix Display
- 64MB SDRAM
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM and Floppy Drive
- NeoMagic® MagicMedia™ 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Microsoft Office 2000 Small Business
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- McAfee VirusScan 4.02
- ★ Upgrade to 3-Year NBD On-site³ Service, add \$99

\$2399

Business Lease¹⁵: \$80/Mo., 36 Mos.

 **E-VALUE CODE: 04170-890923**

DELL INSPIRON 3500

Light Weight, Light Price

- Intel® Celeron™ Processor at 366MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM and Floppy Drive
- NeoMagic® MagicMedia™ 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Microsoft Works Suite 99 with Money 99 Basic
- Microsoft Windows 98 Second Edition
- 3-Year Limited Warranty²
- McAfee VirusScan 4.02
- ★ Mobility Bundle: Internal 56K Capable¹¹ v.90 Fax Modem, MS Office 2000 Small Business and Deluxe Nylon Case, add \$149.

\$1799

Business Lease¹⁵: \$60/Mo., 36 Mos.

 **E-VALUE CODE: 04170-890917**

DELL LATITUDE CPl R

Network-Optimized Notebook

- Pentium II Processor at 400MHz
- 14.1" XGA Active Matrix Display
- 64MB SDRAM (512MB Max¹³)
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- MagicMedia™ 256ZX
- 3D Surround Sound with Wavetable
- Lithium Ion Battery with 1-Hour ExpressCharge™ Technology
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- Touchpad
- 3-Year Next-Business-Day On-site³ Service
- ★ Upgrade to 96MB SDRAM, add \$99.

\$2899

Business Lease¹⁵: \$97/Mo., 36 Mos.

 **E-VALUE CODE: 04170-790928**

DELL LATITUDE CPl

Network-Optimized Notebook

- Intel Celeron Processor at 400MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM (512MB Max¹³)
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- MagicMedia 256ZX
- 3D Surround Sound with Wavetable
- Lithium Ion Battery with 1-Hour ExpressCharge™ Technology
- Microsoft® Windows NT® Workstation 4.0
- Touchpad
- 1-Year Next-Business-Day On-site³ Service
- ★ Upgrade to 64MB SDRAM, add \$99.

\$1899

Business Lease¹⁵: \$64/Mo., 36 Mos.

 **E-VALUE CODE: 04170-790918**

DELL NOTEBOOK AWARD INFORMATION

- Inspiron 3500 C300XT – PC World's Best Buy in the budget category, 6/99, 7/99.
- Latitude CPl A366XT – PC World's #1 Best Buy Power Notebook, 6/99, 7/99.
- Latitude CPl Series A366XT – May Windows Magazine List Fastest Performance, 5/99, 7/99.
- Inspiron 7000 A366LT – PC World's Best Buy Power Notebooks, 8/99.
- Latitude CPl Series 366XT – 5-Time Survivor of PC Computing's Annual Torture Test, 3/99.
- Latitude CPl C400 GT PC Magazine's Editors' Choice Award, 8/99.
- Inspiron 7000 A366LT – PC Magazine's Editors' Choice for small businesses, 2/99.

Advertised configurations vary from award-winning configurations.

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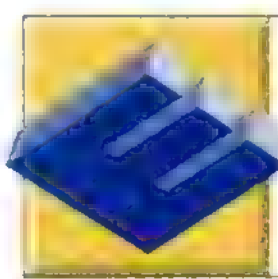
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- Canon BJC-50 Portable Printer, add \$349.
- Infocus LP 400 Ultra Portable Projector, add \$3025.
- Targus Defcon Security Device, add \$49.
- Auto/Air Power Adapter, add \$99.
- APC Notebook Surge Protector, add \$29.
- iomega Click! PC Card Drive, add \$219.
- WinFax Pro v.90 \$105.



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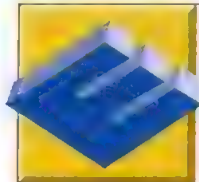
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- 7x24 Dedicated Server Hardware Telephone and Online Technical Support

\$11,749

Business Lease¹⁵: \$387/Mo., 36 Mos.

 **E-VALUE CODE: 04171-290901**

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Departmental Server

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- Two Intel Pro/100+ PCI Ethernet Adapters
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
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- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1.6" Hard Drive Bays
- 4-5.25" Media Bays
- 3-Year Next-Business-Day On-site³ Service
- 1-Year DirectLine NOS Support (5 Resolutions)
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support

\$5349

Business Lease¹⁵: \$179/Mo., 36 Mos.

 **E-VALUE CODE: 04171-290953**

DELL POWEREDGE 2300 SERVER (RAID 5 CONFIGURATION)

Workgroup Server

- Pentium III Processor at 550MHz
- 256MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
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- **Ultra-2/LVD PowerEdge Expandable RAID Controller 2 (Single-Channel)**
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- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1" Hard Drive Bays
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\$4399

Business Lease¹⁵: \$147/Mo., 36 Mos.

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- Cisco 1604 Ethernet ISDN Router with NT-1, add \$1502.
- 3Com OfficeConnect 8/TPO, add \$74.
- 3Com Connect TP 800 8-port TP, add \$164.
- 3Com Superstack II Dual Speed Hub 500, 12-port, add \$674.
- HP JetDirect 300x External 10/100 Base TX Printer Server, add \$245.
- 3Com Sportster 56K Capable¹¹ v.90 External Modem, add \$149.
- Princeton 15" Black Monitor, add \$229.
- HP LaserJet® 1100SE, add \$399.
- 3Com OfficeConnect ISDN LAN Modem, add \$406.
- 3Com Super Stock II Dual Speed 500 24 Port 10/100, add \$905
- Cisco 1604 Router, add \$1503
- 3Com USB Network Interface, add \$57
- HP Pro Curve 10 Base-T Hub*, add \$65
- Cisco 1548 Micro Switch 8 Port, add \$764

DELL POWEREDGE 2300 SERVER (DUAL PROCESSOR/RAID CAPABLE)

Workgroup Server

- Pentium III Processor at 450MHz
- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 9GB* (7200 RPM) Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 40X Max* Variable SCSI CD-ROM Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- Hard Drive Bays: 4-1.6" or 6-1"
- 4 Media Bays: 3-5.25", 1-3.5"
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\$1999

Business Lease¹⁵: \$67/Mo., 36 Mos.

 **E-VALUE CODE: 04171-290919**

DELL POWEREDGE 1300 SERVER (DUAL PROCESSOR/RAID CAPABLE)

Entry-Level Server

- Pentium III Processor at 450MHz
- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 9GB* (7200 RPM) Ultra-2/LVD SCSI Hard Drive
- 32X Max* Variable EIDE CD-ROM Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated PCI Ultra-2/LVD SCSI Controller
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1"
- 3-5.25" Media Bays
- 3-Year Next-Business-Day On-site³ Service
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support
- ★ Microsoft Windows NT Server 4.0, add \$799.
- ★ Upgrade to 128MB 100MHz ECC SDRAM, add \$80.

\$1649

Business Lease¹⁵: \$55/Mo., 36 Mos.

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DELL SERVER AWARD INFO

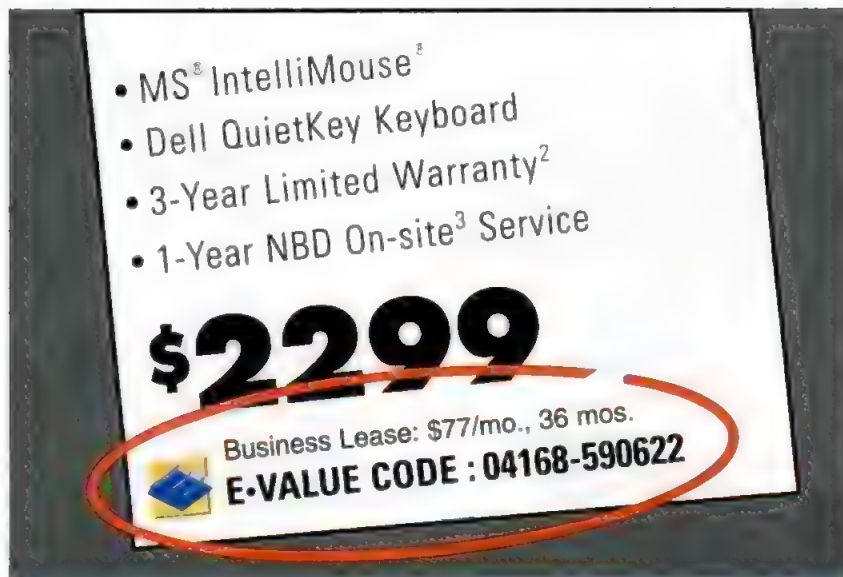
- Network World "World Class Award"—Dell PowerEdge 4300, 7/99.
- Network Computing's "50 Best Products of the Year" — Dell PowerEdge 6300 (Enterprise Server), 5/99.
- Network Magazine "1999 Products of the Year" — Dell PowerEdge 2300 (Workgroup Server), 5/99.
- Computer Shopper "Top 100" — Dell PowerEdge 2300, 11/98.
- PC Computing's "The 'A' List" — Dell PowerEdge 6300, 11/98.
- LANtimes "The Best of LANtimes Over \$25,000" — Dell PowerEdge 6300, 9/98.

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INDUSTRY CLOSE-UP

Silicon Building Blocks

The silicon chip industry comprises thousands of companies: processor vendors, memory makers, chip set

developers, programmable-logic firms, and silicon design automation and verification outfits. A quick scan of the Semiconductor Equipment and Materials International Web site shows over 2,300 member companies that deliver materials and equipment to the semiconductor industry. Add firms supplying chip design and firmware development expertise and consultants providing services ranging from fabrication plant designs to processor sales forecasts and you'll quickly realize the big players in our Top 100—Intel and AMD for example—are only a small part of the story.

In the x86 processor domain, Intel's dominant position will remain unchallenged. AMD has a shot at a strong number two in many market segments, assuming AMD can manufacture and ship its new Athlon chips in quantity and on time. Since late 1998, AMD has produced high volumes of K6-2 chips for the U.S. retail market and captured significant market share. But Intel fought back, applying pricing pressures with its low-cost Celeron chips and forcing AMD into the red. AMD is counting on Athlon, its high-performance, higher-priced chip to boost average selling prices and propel them to profitability.

In early August, chip set vendor **Via Technologies** signed a purchase agreement with **National Semiconductor** to acquire its Cyrix processors and design teams, excluding the MediaGX processor family (which National will retain for information appliances). Via also has a letter of commitment from **IDT** permitting Via to acquire IDT's Centaur x86 processor business, including intellectual property and design teams.

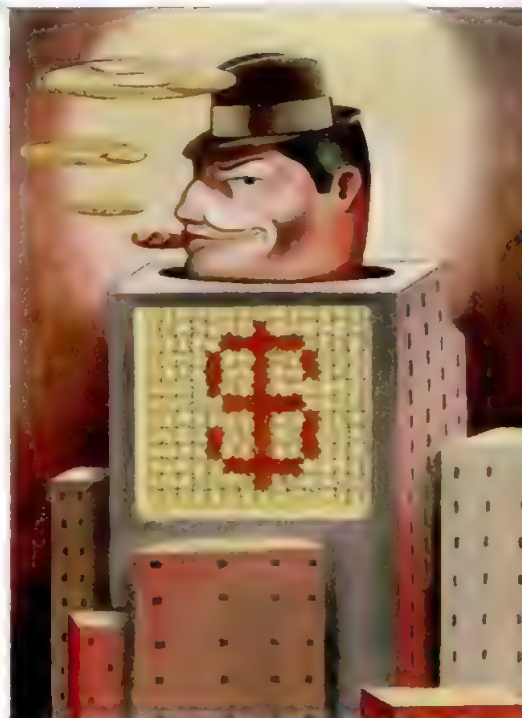
Other entrants into x86 processor space include **Rise Technology** and **Transmeta**. Rise's new mP6 processor is targeted at the low-cost PC market, but the company has

yet to make an impact on the U.S. market, because PC vendors don't see a clear price/performance advantage and may be concerned about supply. Transmeta's technology and battle plans are still under wraps, though rumors are circulating that its chips will first appear in upcoming Amiga systems.

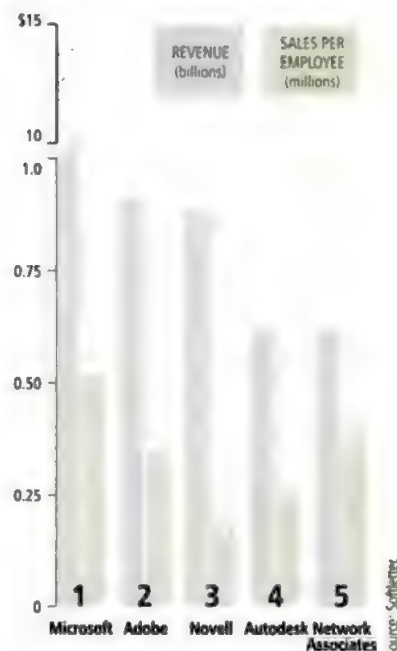
Among memory makers, **Samsung** is the market leader and will be the first to ship **Rambus** memory chips in volume later this year. These chips will be used in nearly all professional/enthusiast Pentium III systems based on the upcoming Intel 820 chip set. They are also expected to be first to market with 1-gigabit DRAM chips (though full-scale production is still four or five years away).

Embedded processors, which have ended up everywhere from set-top boxes to household appliances, dwarf PC processor shipments. The increasing demand for accessing the Internet from a variety of computing and communications devices will drive embedded processor sales even higher. Thanks to the need for storage in notebooks, hand-held computers, pagers, modems, and the increasingly popular digital cameras, the market for flash memory is exploding.

Remaining one of the hottest growth areas, 3-D graphics chips will see a doubling of performance about every six months. We expect all major players to move geometry processing on-board within the next six months; 64MB or even 128MB of local frame buffer memory won't be uncommon by mid-2000. Similarly, we'll see larger amounts of embedded DRAM in mobile graphics chips such as the recently announced S3 mobile Savage chip, which is capable of integrating 16MB of SGRAM or SDRAM on-chip. Altogether, the silicon landscape is thriving. Luckily, we have plenty of sand.—*Nick Stam*



1998 PC Software Sales



Biggest Gain, Biggest Loss

Greatest percent revenue gain:

eBay

724.4

Excite@Home

548.6

Greatest percent revenue loss:

MetaCreations

38.1

Cirrus Logic

34.2



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Mattel Media



David Haddad, president, Mattel Media

Rewriting^{the} Toy Story

Stare down from its high-rise headquarters in suburban Los Angeles and you'll

have no question you've arrived at one of America's premier toy companies. The Mattel logo, carved into the city-block-size patch of lawn, announces to all—and presumably to passengers landing at nearby Los Angeles International Airport—that its customers may be little, but the company does things in a big way.

When Mattel chief executive Jill E. Barad decided the future of toys lay in technology, it was "Barbie bar the door." Mattel Media was formed in 1996, and by March of this year, a management shakeup sent some old-line toy executives packing and left David Haddad, a six-year veteran of The Walt Disney Company, president of the division. And more important, the division was elevated to one of five business units reporting directly to Barad.

Put in charge of growing from a \$100 million to a \$1 billion business, Mattel Media has been busy producing dozens of new software titles—helped along by its acquisition of The Learning Company. But the division made its biggest splash last year with the Barbie Photo Designer Digital Camera and CD-ROM. The marriage of Mattel's turn-on-a-dime manufacturing and off-the-shelf digital imaging parts produced a working camera for under

\$70 that has sold more than 300,000 units. "While everybody else was adding features, we were busy pulling them out to keep the price down," says Haddad.

In August, Haddad inked a deal with little-known Patriot Computers to sell \$600 PCs decorated in Hot Wheels—blue for boys and Barbie-pink for girls. The Barbie computer includes a monitor, speakers, and digital camera along with a flowered mouse, mouse pad, and CD holder. The Hot Wheels PC has a steering wheel input device to match its flame logo design.

The PCs come with \$500 worth of software, much of it culled from The Learning Company, owner of such titles as the Carmen Sandiego series, Riven, and Myst. Mattel has never been averse to acquired market share—it bought Matchbox in a 1997 merger with Tyco Toys, Scrabble in the 1994 purchase of British company J.W. Spear, and Fisher-Price in a 1993 merger—but in acquiring The Learning Company (which already owned Broderbund), Mattel became number one in educational software. "With that merger," Haddad says, "making Mattel Media a \$1 billion business isn't quite the challenge it once was."

Still, Haddad sees Mattel Media as more than a repackager of hardware and software. This is, after all, the company that introduced the groundbreaking Intellivision video game system 20 years ago to an unready public. This time around, the first of its original digital technology toys,

the QX3 Computer Microscope was developed through a joint venture with Intel called Intel.Play. "We really want to use technology to change the way children play," Haddad says. "The lines between play and creating are blurring." Mattel's foray into digital innovation could also be seen as an attempt to boost its sagging stock prices. The toy maker's stock price has fallen from about \$40 in August of 1998 to about \$20 a year later.

The Mattel QX3 Computer Microscope creates magnified computer images of microscopic objects, allowing them to be studied and manipulated by the PC. Bundled software lets kids create time-lapse movies to study the growth of a plant, for instance. And a detachable viewer allows for roaming image captures of such children's favorites as bugs, food, and their own bodies. Other high-tech toys on the drawing board include the Me2Cam video camera, which could do for video chatting over the Internet what the Barbie camera did for digital photo play.

Haddad wants Mattel to create toys that weren't conceivable, much less manufacturable, when digital technology was reserved for NASA and the corporate computer room. Back then, toy companies kept step with the times with toys that were plastic-molded and battery-powered. Even as mechanized amusement parks like Coney Island gave way to electronically controlled theme parks like Six Flags, the toy business stuck with reliable cross-generational brands or team-ups with TV and movies to create toy doppelgangers of *Star Wars* heroes and Saturday morning cartoon characters. "There were a bunch of naysayers who said girls would never play with software," Haddad says. To be able to build the toys of the future, he adds, "Mattel will have to change, too." —JB

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Wired for Management (WfM) Compliant
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MS Office 2000 Small Business Software
3-Year Limited Warranty¹

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36 mos. business lease²

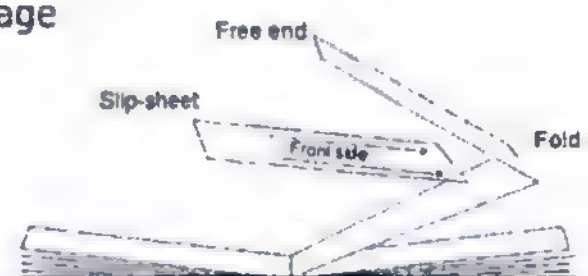
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Solo 9150 three-year on-site service upgrade **\$189**

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2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



Inverted Foldout slip-sheet

Folded edge of the page

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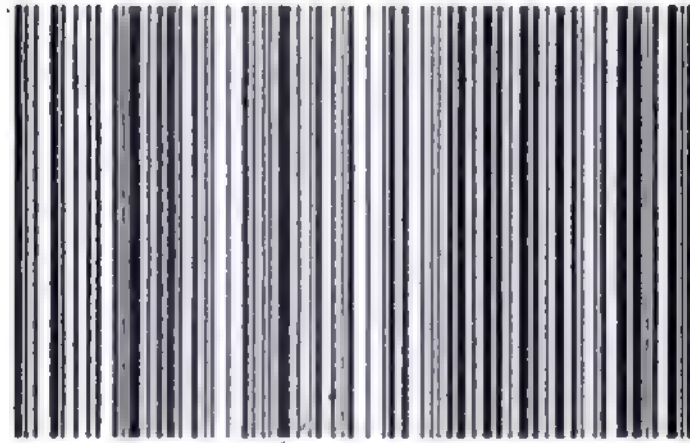
3. Slice the folded edge

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1. Follow instructions on the other side

Inverted Back



Gbs5lpBack-0018

Back

1. Follow instructions on the other side

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MS Office 2000 Small Business Software

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16MB AGP Graphics
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10/100 Ethernet Network Card
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MS Windows 95 or Windows 98

MS Office 2000 Small Business Software

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36 mos. business lease²

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10/100 Ethernet Network Card
Iomega® Internal ZIP™ Drive
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INDUSTRY CLOSE-UP

Converging Devices

At the end of George Orwell's *Animal Farm*, the pigs of Manor Farm and the humans start to look more and more

alike. So, too, will traditional computer, home entertainment, media, set-top box, and telephone companies as they pursue the Holy Grail of digital convergence. Who would have imagined that AT&T—Ma Bell, the *telephone* company—would transform itself and deliver service over cable TV lines.

Exhibit A for convergence is the next-generation **Sony** PlayStation, due stateside next year. It's more than a game player on steroids; the processing power of the PlayStation's CPU is said to be in a league with the Pentium III, and it has a DVD-ROM drive, and IEEE 1394 (FireWire) and USB connections. Add local storage and it could be a PC, a Web browser, a video player, a set-top box, and the controller that makes your TV, VCR, CD player, and video camera could all talk to one another.

Home PCs can morph into convergence devices or information appliances, and the companies best positioned are **Compaq**, **HP**, **IBM**, and **Dell**, all of which have R & D work under way and initial products out. IBM, for example, already sells dedicated home-automation PCs.

Companies now selling into both the Microsoft Windows CE and PC markets have a head start on convergence. **Philips** is well positioned with its broad product line and technical savvy, despite some recent financial and management turmoil. The same holds for the rest of Japan Inc., to varying degrees. Giants such as **Acer**, **Canon**, **Creative Technologies**, **Hitachi**, **LG Group**, **Matsushita**, **Samsung**, **Sharp**, and **Toshiba** could all be contenders by providing end-user products or building the underlying components.

The next round of cellular phones will be PDAs, information appliances, and possibly even two-way TVs. Those best-dressed for success include **Qualcomm**—

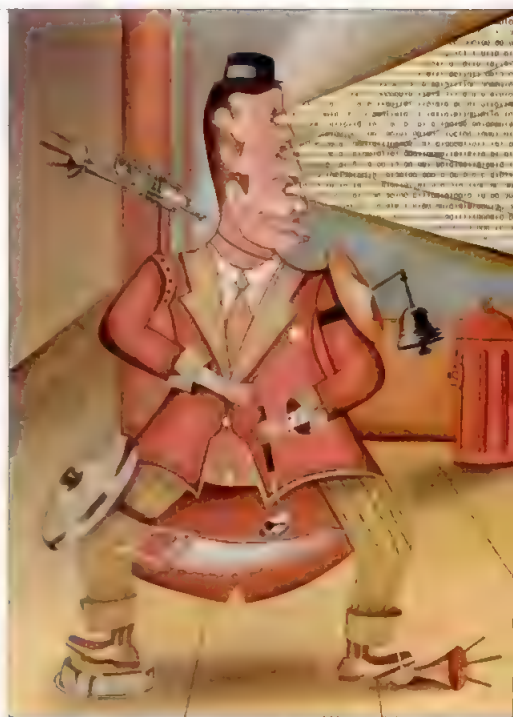
assuming its technically superior CDMA technology dominates over worldwide leader GSM—**AT&T**, **Nokia**, **Ericsson**, and **Motorola**. Many cellular phone makers are pushing Symbian, a compact phone/PDA operating system, which would undercut Microsoft Windows CE, and a short-range phone-to-other-devices data transfer specification, Bluetooth, which **Microsoft** has been slow to embrace.

Media companies are blending traditional media, such as TV news and movies, with the Internet. **Disney** (with ESPN Sportzone, Disney, GO Network), **NBC** (with MSNBC, NBC, and Snap.com), and **Time Warner** (CNN and the moribund Pathfinder) are front-runners along with Sony (the entertainment company). **America Online** has evolved from ISP to portal to way of life for many users.

Until bandwidth is nearly unlimited and nearly free, the providers of the pipes will shape convergence. AT&T's acquisition of cable companies means your phone service could come over a cable TV line. Conversely, the Baby Bell spin-offs such as **Bell Atlantic** are trying to see how much bandwidth they can pump over phone lines. And they're all jockeying with the FCC to see if they have the right to keep competitors off their pipes.

If these players win, who loses? Smaller companies with limited resources. **Microsoft** and **Intel** could be less dominant factors only because they'll have a tough time duplicating the market share they have in the purely PC business. The changing market may indeed do the job for the Justice Department.

This revolution, unlike Orwell's vision of Communism gone awry, should turn out well for the masses. It's going to be dicey, though, for the players, as they simultaneously reach out to new markets and protect their traditional turf.—*Bill Howard*



Top Shopping Sites

	Unique visitors per month*
1 Amazon.com	11,167,000
2 AOL Shopping	10,328,000
3 Blue Mountain Arts	9,860,000
4 eBay	8,655,000
5 Barnesandnoble.com	4,747,000

Top Web Properties

	Unique visitors per month*
1 AOL Network**	47,197,000
2 Yahoo! sites	37,093,000
3 Microsoft sites	32,883,000
4 Lycos	29,963,000
5 GO Network	20,793,000

* Each user is counted only once.
** Both member and public sites.

Source: Media Matrix, June 1999.

Research and Development Highs and Lows

Highest R & D as percent of total revenue:

Inktomi	CMGI
59.8	41.9

Lowest R & D as percent of total revenue:

AT&T	Gateway
1.2	1.0



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emachines



Stephen A. Dukker, CEO

the VW of PCs

The grid of low-rise office buildings, banks, and sandwich shops comes almost to an

end where the Santa Ana Mountains rise above the 80,000-square-foot warehouse that's taking in its latest shipment from the port of Long Beach. Stacked two stories high, the Korean-made PCs and monitors are packed in color-coded boxes, marked with a lower-case e—for emachines, that is.

Volume is the name of the game at emachines, the come-from-nowhere PC company that within a year of its 1998 founding was already shipping 450,000 machines a quarter and is now number three in U.S. retail PC sales. Price has everything to do with those kinds of sales; a low-end emachines PC costs about \$500 with a 14-inch monitor, and—depending on the rebate deal and the seller—sometimes even less.

Price, volume, and inventory are the Holy Trinity of retailers and, sure enough, emachines is the brainchild of a 16-year retail veteran who helped bring the superstore concept to PCs at CompUSA and Computer City. Calling on his sales skills and Pacific Rim contacts, chief executive Stephen A. Dukker pulled emachines together by negotiating working capital and contract manufacturing from Korean PC maker TriGem Computer and monitor maker Korea

Data Systems. \$500 PCs have been around for a while, but they were always last year's mistakes," says Dukker, who insists that his PCs have the latest designs and components from proven manufacturers.

emachines' newest entry is the one-piece eOne, which owes much of its aesthetic to the Apple iMac (see the First Looks review of the eOne in this issue). So much so, in fact, Apple has filed suit against emachines, claiming the eOne copied its design. The eOne includes a 15-inch monitor, 433-MHz Intel Celeron CPU, 64MB of RAM, a 6.4GB hard disk, a 56K modem, and, unlike the iMac, a 3.5-inch floppy disk drive. The eOne's features were unthinkable in an \$800 computer a year ago. And buyers who sign up for three years of CompuServe 2000's Internet service can have the blue-and-white workhorse for half that price.

It's the Internet, after all, that makes emachines possible. "The three home uses of a PC used to be games, personal finance, and homework," says Dukker. "Now it's the Internet, the Internet, and the Internet." This provides not only motivated buyers, but also plenty of sellers. In one sense, these ISPs are working toward the business model employed by razor makers and cell-phone service providers: Lower the cost of entry and reap long-term gains. And unlike in recent years, for many people there's little motivation to buy the most powerful PC, when an emachine is a capable doorway to the Web.

Still, signing up such big-name retailers as Best Buy, Circuit City, and Sears with just 50 employees may be the easy parts for Dukker, who is painfully aware of the fate of yesteryear's low-cost PC makers. Discount models have typically attracted novice users whose need for more telephone support costs the seller dollars when handled right and reputation when handled wrong. In keeping with emachines' minimalist front-office approach, Dukker outsourced telephone support. Moreover, he is convinced the low-cost buyer is no longer a novice, but more often a student or seasoned pro who needs a second home machine.

Some emachines customers still seem to need a helping hand. Roughly one in three calls in a 15-minute period recently required an explanation by the company receptionist that the support lines were very busy. For customers frustrated enough to call the Irvine headquarters, emachines has a backup support line. Keeping customers off hold will likely prove vitally important for the young upstart company, as more potential buyers become aware of the snazzy e logo. "emachines' push now is to brand equity," says Charles Smulder, senior analyst at Dataquest. "They've had an easy time of it so far, because they haven't been challenged on price yet."

Hinting at emachines' discounting, a Gateway ad warns that economy PCs are risky because Brand X may not include all the frills of a more expensive purchase. Of course, Gateway, along with Dell, was once Brand X to Compaq, which got its start by undercutting IBM's prices. "Just as Dell and Gateway came up with a new business model in the 1980s, we're the new model for the 1990s," says Dukker, who nonetheless recognizes the peril of a low-margin business. "Whether we succeed or not, we will have changed the world by making the PC affordable for so many people." —JB



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Editors' Hot Links



► CorpTech Database of Technology Companies

www.corptech.com

A database of public and private technology companies worldwide: Basic directory information and a brief profile are free; an expanded profile and additional information is available for a fee.

► ZDNet Company Finder

www.companyfinder.com

This database of U.S. computer

and Internet industry companies includes basic directory information, a brief profile, and links to stock quotes, key financials, company news, and other information.

► Hoover's IPO Central

www.ipocentral.com

An excellent source of information on initial public offerings since May 1996, this site covers companies that have gone public

as well as those that have filed but have not yet started trading.

► FreeEDGAR.com

www.freeedgar.com

This site offers free, up-to-the-minute access to Securities and Exchange Commission company filings.

► Silicon Investor

www.techstocks.com

A good place to turn for investment information on publicly traded high-tech companies, this site offers extensive discussion forums and customization options as well as stock quotes, financials, company news, and more.

► Market Guide

www.marketguide.com

Investment information that covers U.S. public companies and foreign companies that are traded in the U.S.

► ZD Interactive Investor

www.zdii.com

An extensive resource for investment information on publicly traded high-tech companies. This site offers stock quotes, financial information, broker research and analyst commentary, as well as company news from ZDNet, BusinessWire, Reuters, and PR Newswire.

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Our Contributors: JAKE KIRCHNER is the editor of PC Magazine. FRANK J. DERFLER, JR., is the senior networking editor, BILL HOWARD is the senior executive editor, and NICK STAM is a technical director at the magazine. JIM BARTIMO is a freelance writer, NANCY SIRAPYAN is the PC Magazine librarian, and associate editor NANCY HIRSCH was in charge of this story.

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IBM P92

Who can resist a case in "stealth black"?



19-INCH MONITORS

THE BIG PICTURE

By Alfred Poor

The interesting news in monitors goes beyond the fact that 19-inch monitors are the fastest-growing category in the field, with 40 percent growth over last year's sales numbers. The big news is that the quality of these units is top-notch—across the price range. From those costing a little over \$300 to the high-end \$1,000 models, the on-screen image quality is thoroughly impressive. Of course, advanced features that are important in high-end graphics work, like convergence tuning and moiré adjustment, tend to add a premium to a monitor's price. But in general, the 19-inch monitors we looked at are more than adequate for both business and graphics or CAD use.

19-inch monitors are affordable, and they don't take up much more desk space than 17-inch models. For those reasons, we see them becoming the standard for any business environment that involves PC-intensive work.

19-INCH MONITOR FEATURES

Cathode-ray tubes (CRTs) have improved significantly over the years. In the



Sony Multiscan
GDM-F402



Way-cool joystick on the front panel, which is also easy to use.

**Samsung
SyncMaster 900p**

A cool blue stripe runs across the top, which is also flat, making it suitable as a mantelpiece for family photos.

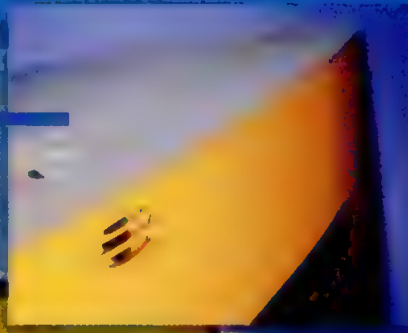


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Tatung C9RZT

Built-in microphones in the fronts of the ADI MicroScan and Tatung monitors.

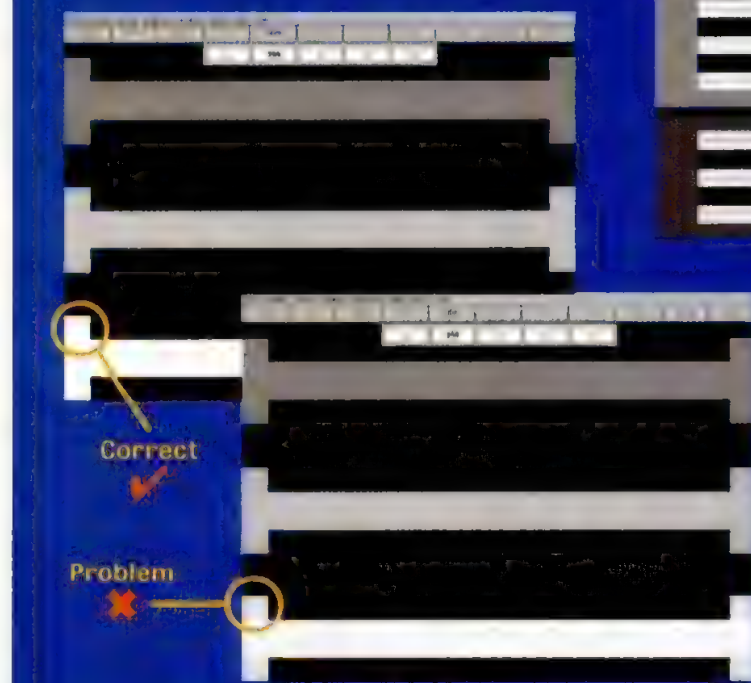


Nokla 446XS

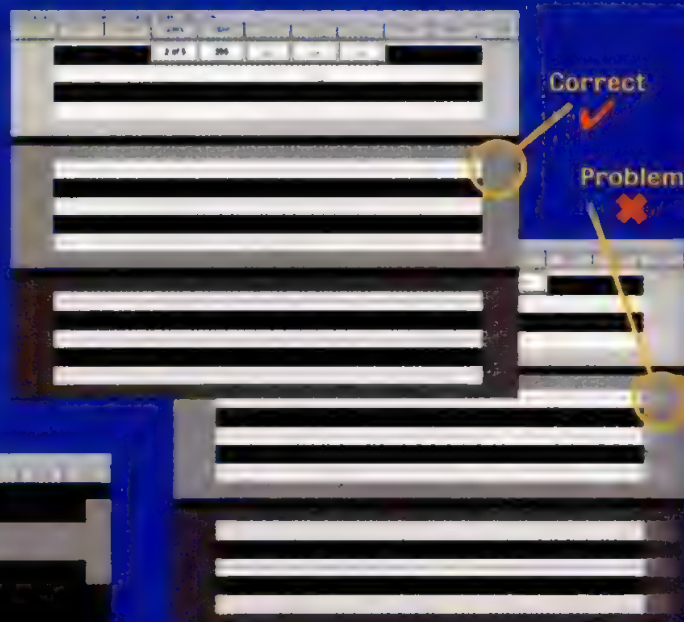
The "legless" wonder lies low, so that you can look down on your monitor.



MONITOR MISSTEPS



GRAY-SCALE SHIFT Monitors must change intensity (or voltage) when moving from black to gray or black to white. When there is a problem, you'll notice that the image is not true gray or true white but retains some of the adjacent black color.



STREAKING Ghosting and shadowing can occur when there are large changes in intensity between adjacent areas on the screen. This phenomenon is most noticeable in charts or toolbars that have large blocks of adjacent solid colors.

Here are some of the problems that monitors exhibited during our lab testing. These abnormalities showed up while the units were being subjected to the battery of DisplayMate tests.

past, monitor tuning was limited to analog brightness and contrast controls; all other image adjustments had to be set at the factory. Today, almost all monitors use digital controls. And fortunately, most companies have implemented on-screen displays that provide a menu of control options. In addition to the standard controls for brightness, contrast, image size, and position, you now get a wide range of sophisticated controls. Most monitors have adjustments for color temperature, pincushioning, and trapezoidal distortion. Some even include more sophisticated settings, such as convergence error correction or adjustments to reduce moiré patterns. One user interface feature worthy of spe-

cial note is the tiny joystick on the front panel of the Sony Multiscan GDM-F400. This joystick is very easy and intuitive to use, in sharp contrast with the multibutton controls on the other Sony in this field.

LOOKING GLASS

Perhaps the most impressive improvements have been in the picture tubes some of these monitors use. The most significant developments are flat screens and short-depth CRTs.

Most CRTs have screens that curve both vertically and horizontally, as if they were cut from the surface of a large beach ball. Aperture-grille designs such as the Sony Trinitron and the Mitsubishi

Diamondtron are curved in the horizontal plane but flat in the vertical plane, as if cut from a huge cylinder instead. New tubes have come on the market that are flat in both dimensions. The resulting displays are much less susceptible to glare and reflections from ambient light sources, and in image quality they resemble the crisp, clear displays on LCD monitors.

Besides having flatter faces, CRTs are getting shallower. A rule of thumb is that a monitor case will be at least as deep as the diagonal measurement of the screen. Thanks to sophisticated advances in electron gun technology, 19-inch monitors on the whole have shorter yokes than you might expect, and as a result, their cases are not as deep. Some manufacturers have advanced this technology even further, making some new 19-inch monitors even

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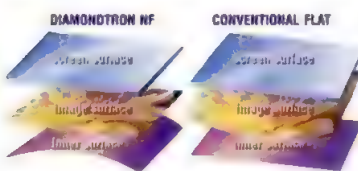
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DIAMONDTRON NF



two computers automatically. With DIAMONDTRON NF monitors, Mitsubishi will forever change your view of the world. The difference is right before your eyes. For more

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shorter. The Panasonic PanaSync SL90 reviewed here is just 16.3 inches deep. A few inches can make a big difference when you're trying to shoehorn a large monitor into a typical corporate cubicle.

SORTING THROUGH THE FIELD

For this roundup, we gathered 36 19-inch monitors and 1 20-inch unit. We required only that the monitors were available in at least two U.S. retail outlets and that they were final, production-level products. The units cover a wide range of features—and prices, ranging from \$320 to \$1,000 street.

All of these monitors performed well, and few had serious flaws that would interfere with general business use. In-depth reviews would probably not help you differentiate among them. Instead, we started by measuring the performance of each monitor in great detail. We took measurements using the Microvision SuperSpot system, and we also made observations of the image quality using the DisplayMate software (www.displaymate.com). We ranked the monitors based on the results of these two sets of tests, and then we set aside the 14 with the best overall performance. Using a jury to score those final 14 on a number of criteria covering different types of applications, we produced the final ranking you see here. Though only the top 14 monitors are reviewed in this story, be sure to go to the *PC Magazine* Web site (www.pcmag.com) to find reviews of all the other units in this roundup.

Keep in mind that the final 14 and the rest of the pack are often separated only by small differences. Because almost all of the monitors are of fundamentally good quality, small margins and subtle details are often the deciding factor. For example, a graphic artist might think that color uniformity is important, while a CAD user might see excellent convergence as essential. Either of these users might reject a monitor that an average business user could find perfectly acceptable.

Interestingly, none of the aperture grille or flat-screen monitors made our final 14. In many cases, they were eliminated for screen geometry flaws: Circles appeared slightly squashed, or image edges were not perfectly straight. These would not be fatal flaws for most buyers, but they were enough to move such monitors aside

Editors' Choice

- MAG InnoVision 800v
- LGStudioworks 995E



The MAG InnoVision 800v and the LG Studioworks 995E offer a combination of quality, features, and price that edges out the competition.

For overall value, it's hard to top the \$400 MAG InnoVision 800v. Ideal for the business or home user, this model has an easy-to-operate user interface and enough fine-tuning features to please a high-end user.

Our jury ranked it number one for image quality in both the business and graphics categories.

Graphics and CAD users should look no further than the LG Studioworks 995E. Its \$470 price is well below that of many other monitors targeted at the professional graphics user, but it doesn't skimp on features or image quality.

The 995E is especially adept at handling high resolutions and graphics-intensive applications.

in our search for the best of the best.

Our Editors' Choice for overall value is the \$400 MAG InnoVision 800v, while our nod for Editors' Choice in the graphics category goes to the LG Studioworks 995E. Here are the final 14, presented in rank order based on the results of our jury tests. Again, keep in mind that the margins are small; we even had a three-way tie at one position.

MAG INNOVISION 800V

The MAG InnoVision 800v is part of the company's v line, where the v stands for *value*. The monitor certainly lives up to the name, as its \$400 price tag represents one of the best values of the entire roundup.

The monitor has a 0.23-mm horizontal dot pitch; it came out on top on our jury tests for both business and graphics applications, with sharp, steady images and

good color. The 800v showed excellent convergence on the SuperSpot measurements and demonstrated good image geometry and size regulation with the DisplayMate program. Among a field of excellent monitors, this one earned top marks as an all-around performer. (MAG Technology USA Inc., Irvine, CA; 800-827-3998; www.maginnovision.com.)

LG STUDIOWORKS 995E

Close behind the MAG InnoVision 800v on our jury test was the LG Studioworks 995E. This monitor (with a 0.22-mm horizontal dot pitch) carries the aggressive price of \$470 and represents an excellent bargain. It is intended for graphics and high-resolution applications, and our test results supported this positioning.

The jury gave the 995E near-perfect marks for both general business and graphics applications. SuperSpot measurements indicated one of the highest contrast ratios. The DisplayMate tests indicated excellent screen geometry. (LG Electronics USA Inc., Englewood Cliffs, NJ; 800-243-0000; www.lgeus.com.)

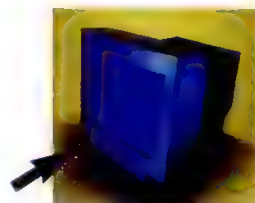
Three monitors shared the honors at the third-place position. They are presented here in alphabetical order by company.

EIZO NANAO FLEXSCAN FX-D7

The EIZO Nanao FlexScan FX-D7 has a horizontal dot pitch of 0.22 mm and, at \$790, is priced at the high end of the field. The company targets large corporate customers, however, so the final unit cost may be affected by volume pricing.

The monitor has a clean design, with a

ONLINE



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MONITOR ROUNDUP

Model	Viewable screen size (diagonal, in inches)	Street price	Tube type	CRT manufacturer	Horizontal dot or stripe pitch (mm)	Depth (inches)/Weight (pounds)	Refresh rate (Hz)*	Video inputs	Powered USB port	Number of USB ports
MAG InnoVision 800v	18.0	\$400	Shadow mask	Hitachi	0.23	18.2/48.4	75/86	VGA	☐	0
LG Studioworks 900E	18.0	\$470	Shadow mask	Hitachi	0.22	18.7/52.8	80/90	VGA	☐	0
EIZO Nanao FlexScan FX-D7	17.8	\$790	Shadow mask	Hitachi	0.22	18.8/52.9	76/89	VGA, BNC	☒	5
Hansol 900P	18.0	\$400	Shadow mask	Samsung	0.23	24.4/52.9	75/85	SVGA	☐	0
IBM G96	17.9	\$600	Shadow mask	Info not available	0.22	16.7/53.0	75/85	VGA	☐	0
Corsairone P1400	18.1	\$700	Shadow mask	Hitachi	0.22	18.4/55.0	85/97	VGA	☐	0
PlanOne DataView G400	18.0	\$470	Shadow mask	Hitachi	0.22	18.8/48.5	75/86	VGA	☐	0
Argon Pro T300	18.3	\$430	Shadow mask	Toshiba	0.23	18.9/54.0	77/86	VGA	☐	0
Optquest V95	18.0	\$380	Shadow mask	Samsung	0.23	17.7/48.4	76/88	VGA, BNC	☐	0
Primostar E0900	18.1	\$530	Shadow mask	Samsung	0.23	18.9/50.6	75/86	VGA	☐	0
Philips 1600	18.0	\$480	Shadow mask	Hitachi	0.22	16.5/46.0	75/85	VGA	☒	1
Envision AOC Spectrum 96LMS	18.0	\$320	Shadow mask	Philips	0.23	16.5/42.9	75/85	VGA	☐	0
ADI MicroScan G01	18.0	\$490	Shadow mask	Panasonic	0.23	16.5/49.5	75/86	VGA	Optional	4
Panasonic PanSync SL30	18.0	\$650	Shadow mask	Matsushita	0.22	18.3/47.3	76/88	VGA	Optional	4
AcerView 96SL	18.0	\$400	Shadow mask	Philips	0.23	18.7/48.3	78/91	VGA	Optional	5
Compaq S300	18.0	\$500	Shadow mask	Info not available	0.23	18.0/57.0	76/88	VGA	☐	0
CTX VL900S	18.0	\$440	Shadow mask	Panasonic	0.22	16.8/48.0	75/85	VGA	☒	4
Daytek Vista V10	18.0	\$460	Shadow mask	Samsung	0.23	18.5/52.9	77/88	VGA	☐	0
Dell P301	18.0	\$600	Aperture grille	Sony	0.22	18.2/56.9	85/96	VGA	☐	0
HP 90	18.0	\$680	Aperture grille	HP	0.25	18.3/53.6	75/85	VGA	☐	0
Hyundai DataScan P300	18.0	\$420	Shadow mask	Samsung	0.23	18.5/47.6	75/85	VGA, BNC	☐	0
IBM P32	17.9	\$670	Aperture grille	Sony	0.25	18.7/55.0	75/85	VGA	☐	0
Iiyama VisionMaster 430	18.0	\$460	Shadow mask	Hitachi	0.22	17.6/50.7	82/94	VGA, BNC	☐	0
Iiyama VisionMaster Pro 430	18.0	\$700	Aperture grille	Mitsubishi	0.25	17.6/62.0	86/107	VGA, BNC	☐	0
MaxTech XT-9001	18.0	\$400	Shadow mask	LG Electronics	0.23	18.5/50.0	75/N/A	SVGA	☐	0
MGC-9107	18.0	\$400	Shadow mask	Toshiba	0.23	19.0/51.9	85/100	VGA	☒	1
Mitsubishi Diamond Pro 3000	18.0	\$600	Aperture grille	Mitsubishi	0.25-0.27	18.0/55.0	75/85	VGA, BNC	☒	5
NEC MultiSync FP300	18.0	\$750	Aperture grille	Mitsubishi	0.25-0.27	17.6/59.8	86/85	VGA, BNC	☒	1
Nokia 445Kpro	17.7	\$740	Shadow mask	Hitachi	0.22	18.6/50.6	85/99	VGA, BNC	☒	5
Nokia 445XS	17.8	\$670	Shadow mask	Panasonic	0.22	16.5/48.5	75/90	VGA	☒	5
Samsung SyncMaster 900p	18.0	\$430	Shadow mask	Hitachi	0.22	19.4/49.6	75/85	VGA	☐	0
Sceptre Dragon Eye 807A	18.0	\$400	Shadow mask	Toshiba	0.22	18.9/55.0	76/90	VGA	☐	0
Smile CA9016SL	18.0	\$700	Shadow mask	Matsushita	0.22	16.1/48.2	75/85	VGA, BNC	☒	1
Sony Multiscan CPD-420GS	18.0	\$800	Aperture grille	Sony	0.25-0.27	18.0/57.0	75/85	VGA	☐	0
Sony Multiscan GDM-F400	18.0	\$1,000	Aperture grille	Sony	0.25-0.27	17.9/60.6	85/85	VGA, BNC	☒	5
Tosung CRZT	17.9	\$350	Shadow mask	Hitachi	0.22	18.2/55.0	75/85	VGA	☐	0
ViewSonic P7735	18.0	\$380	Aperture grille	ViewSonic	0.25	19.0/51.9	85/100	VGA	☒	1

*Maximum noninterlaced vertical refresh rate at 1,600-by-1,200 and 1,280-by-1,024 resolution. N/A—Not applicable: The product does not have this feature.

clever drop-down USB port that is easily reached from the front. The front-panel controls are easy to use and support an extensive range of user settings via the on-screen display. The FX-D7 earned perfect marks from our jury for business applications, with a somewhat lower score for graphic arts use because of a slightly lower score on the contrast test. The SuperSpot results indicated excellent convergence and uniformity. (EIZO Nanao Technologies, Cypress, LA; 800-800-5202; www.eizo.com.)

HANSOL 900P

The \$400 price tag on the Hansol 900P is among the lowest in the pack, yet its test scores placed the monitor near the top.

The 0.23-mm horizontal dot pitch is aimed at general business applications and graphic arts. The control disk was too easy to click in error, and the on-screen display could be organized better for ease of use; some settings were buried under the uninformative heading "more settings."

The 900P garnered top scores on the graphic arts portion of the jury tests with good scores on the business applications as well. It was a little weak on the DisplayMate focus and image-regulation tests but was generally good otherwise. The SuperSpot tests revealed above-average contrast and convergence. (Hansol Multitech Inc., La Palma, CA; 800-426-7651; www.hansol-us.com.)

IBM G96

The IBM G96 boasts a short-neck tube design and a horizontal dot pitch of 0.22 mm. A street price of \$600 places it in the top half of the price range, but it is the only finalist available in a choice of "pearl white" or "stealth black" cases. The short neck lets Sony fit the tube in a case that is only 16.7 inches deep.

The G96 is part of IBM's General Business Series product line, and our jury judged it excellent for general business applications. The jury did not see any obvious flaws while viewing graphics images, though DisplayMate revealed some weakness in geometric accuracy. The G96 earned the top position on the SuperSpot tests, with strong contrast and

HARDWARE

19-Inch Monitors

Trapezoid/ parallelogram/ pincushion balance	Tilt/Con- vergence/ Moiré cancellation	Warranty	Quick- exchange program under warranty	Usability	Graphics image quality	Business image quality	▲ Pros. ▼ Cons.
■■■■	■■■■	3 years	□	Excellent	Excellent	Excellent	▲ Good screen geometry and image quality ▼ Slightly weak on contrast.
■■■■	■■■■	3 years	□	Excellent	Excellent	Excellent	▲ Excellent contrast ratio and screen geometry ▼ Slightly weak on focus
■■■■	■■■■	3 years	■	Excellent	Excellent	Excellent	▲ Excellent image quality ▼ High price.
■■■■	■■■■	3 years	■	Fair	Good	Excellent	▲ Good contrast ratio and convergence ▼ Awkward user interface
■■■■	■■■■	3 years	□	Good	Excellent	Excellent	▲ Short depth, excellent image quality. ▼ Slightly nonuniform brightness.
■■■■	■■■■	5 years	■	Excellent	Good	Good	▲ Big-screen utility software, excellent screen geometry. ▼ Low contrast ratio.
■■■■	■■■■	3 years	■	Fair	Good	Good	▲ Good contrast. ▼ Cluttered front panel.
■■■■	■■■■	3 years	■	Good	Good	Good	▲ 48-hour advance replacement. ▼ Weak tonal range in dark grays.
■■■■	■■■■	3 years	Optional	Good	Good	Good	▲ Stable and uniform image. ▼ Some screen geometry flaws.
■■■■	■■■■	3 years	■	Good	Good	Good	▲ Good screen geometry. ▼ Weak contrast, inconsistent gray levels.
■■■■	■■■■	3 years	■	Excellent	Good	Good	▲ Excellent contrast, good geometry. ▼ Poor uniformity, moderate streaking.
■■■■	■■■■	3 years	■	Excellent	Good	Good	▲ Low price, excellent convergence. ▼ Weak regulation of image size and focus.
■■■■	■■■■	3 years	■	Excellent	Good	Excellent	▲ Short depth. ▼ Slight problem with uniform geometry.
■■■■	■■■■	3 years	■	Good	Good	Good	▲ Good uniformity and MTF scores. ▼ Some screen geometry flaws.
■■■■	■■■■	3 years	□	Good	Good	Good	▲ Good geometry. ▼ Awkward user interface.
■■■■	■■■■	3 years	■	Good	Fair	Good	▲ Good contrast ratio. ▼ Weak on focus.
■■■■	■■■■	3 years (tube, 2 years)	□	Fair	Fair	Good	▲ Uniformly bright screen. ▼ Cluttered front panel.
■■■■	■■■■	3 years	■	Fair	Fair	Fair	▲ High video bandwidth index. ▼ No moiré adjustment.
■■■■	■■■■	3 years	□	Good	Good	Good	▲ Good geometry and focus. ▼ Poor image-size regulation.
■■■■	■■■■	3 years	□	Excellent	Fair	Good	▲ Good usability. ▼ Poor convergence.
■■■■	■■■■	3 years	■	Good	Fair	Good	▲ Convenient controls. ▼ Black level inconsistent on different images.
■■■■	■■■■	3 years	□	Good	Fair	Good	▲ Excellent contrast ratio and a nice stand. ▼ Weak screen geometry.
■■■■	■■■■	3 years	■	Good	Good	Good	▲ Excellent screen geometry. ▼ Images appear slightly out of focus.
■■■■	■■■■	3 years	■	Good	Good	Good	▲ Good uniformity and screen geometry. ▼ Poor video bandwidth, low MTF scores.
■■■■	■■■■	3 years	□	Good	Fair	Fair	▲ Good user interface. ▼ Convergence and geometry problems.
■■■■	■■■■	3 years (tube, 2 years)	□	Good	Fair	Fair	▲ Good contrast. ▼ Poor focus and uniformity.
■■■■	■■■■	3 years	■	Good	Fair	Good	▲ Excellent contrast. ▼ Overshoot problems.
■■■■	■■■■	3 years	■	Good	Fair	Good	▲ Good focus. ▼ Low MTF scores and overshoot.
■■■■	■■■■	3 years	■	Excellent	Fair	Excellent	▲ Good focus and stability. ▼ Low contrast and poor uniformity.
■■■■	■■■■	3 years	■	Excellent	Good	Good	▲ Good screen geometry, attractive low-profile case. ▼ Inconsistent gray levels.
■■■■	■■■■	3 years	■	Good	Fair	Good	▲ Excellent contrast and stable image. ▼ Poor geometry and uniformity.
■■■■	■■■■	3 years (parts, 5 years)	■	Good	Good	Good	▲ Good uniformity. ▼ Inconsistent gray levels.
■■■■	■■■■	3 years	■	Good	Fair	Good	▲ Good geometry. ▼ Localized uniformity problems, inconsistent gray levels.
□■■■	■■■■	3 years	■	Good	Good	Good	▲ Excellent uniformity, good focus. ▼ Some screen geometry flaws.
□■■■	■■■■	3 years	■	Excellent	Good	Good	▲ Excellent contrast. ▼ Some screen geometry flaws.
■■■■	■■■■	3 years (tube, 2 years)	■	Good	Fair	Good	▲ Good geometry and uniformity. ▼ Moiré flaws and no available adjustment.
■■■■	■■■■	3 years (tube, 2 years)	□	Excellent	Fair	Good	▲ Excellent contrast. ▼ Some screen uniformity and geometry flaws.

convergence scores. (IBM Personal Systems Group, Research Triangle Park, NC; 800-426-7255; www.ibm.com/options.)

CORNERSTONE P1400

The Cornerstone P1400 has a horizontal dot pitch of 0.22 mm and is aimed at professional CAD/CAM and desktop publishing users, with a street price of \$720. The monitor comes with a handy utility suite, BigMonitor Software. This collection of programs makes it easy to perform complex configuration tasks quickly.

The Cornerstone monitor received some of the best marks on our jury tests for graphic arts use and a strong score for business applications. The SuperSpot uniformity result was below average, but the

monitor did well on contrast, and the DisplayMate results indicated excellent screen geometry. (Cornerstone Peripherals Tech Inc., Freemont, CA; 800-562-2552; www.bigmonitors.com.)

PLUSONE DECAVIEW 6400

The Graphic Series from PlusOne Technologies is designed for high-end graphics users. The unit has a 0.22-mm horizontal dot pitch and a price of \$470. The front panel is cluttered with nine control buttons (plus a power switch), and the on-screen display is notably less intuitive than most competitors'.

Once you've configured the display, however, you should get good results. The jury judged it near the top in both busi-

ness and graphics applications. DisplayMate tests indicated a little weakness in focus and image-size regulation, and the SuperSpot suite reported some slight misconvergence and small variations in brightness uniformity. These were small flaws, however, and the image was still judged excellent. (PlusOne Technologies Corp., City of Industry, CA; 800-707-6688; www.decaview.com.)

ARGON PRO T996

The Argon Pro T996 displays excellent images, with a 0.23-mm horizontal dot pitch, and its \$430 price tag is below average. Despite the low price, the company offers a 48-hour advance replacement warranty for three years.

PERFORMANCE TESTS

19-Inch Monitors



We have separated the elite 14 monitors from the field through two rounds of objective tests. We ran all of the monitors through the rigors of the Microvision SS200 display quality measurements and the visual inspection using the test patterns produced by DisplayMate Technologies (www.displaymate.com). We then picked 14 monitors that performed

well on both sets of tests and presented them to our panel in a sequence of blind jury tests.

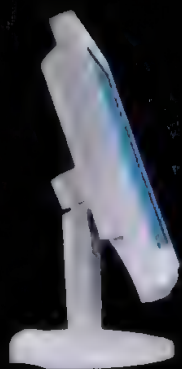
Contrast Ratio: The contrast ratio is calculated by comparing the luminance of a white screen to a black screen at nine evenly distributed spots on the surface of the CRT. A high contrast ratio is conducive to producing more vivid and well-defined images.

Modulation Transfer Function (MTF): The MTF measurements involve thin green line pairs that are displayed in both horizontal and vertical directions. The higher the contrast of the brightness of the lines to the darkness in between two lines, the better the monitor can resolve fine objects or high-frequency patterns. **Screen Nonuniformity:** The luminance is measured at nine evenly spaced spots on the CRT, and the maximum difference is reported as a percentage of the maximum brightness. A perfectly uniform monitor would

score 0 percent. **Horizontal and Vertical Nonlinearity:** An image may not appear to be the same size everywhere on the screen. A perfect monitor would have a 0-mm difference in the size of an object displayed at the center versus the size at the left, right, top, or bottom. **Focus:** We use the Focus Matrix test in DisplayMate. The test screen displays a pattern in four variations, with variation 1 being the coarsest and variation 4 the finest. We record the number of the highest variation that the monitor can resolve. **Internal Geometry:** We use the Internal Pincushion and Barrel Distortion tests in DisplayMate to rate the accuracy of geometry at the middle part of the screen. **Screen Regulation:** On many monitors, the size of an image can vary depending on the brightness. We score on a 4-point scale, with 4 being the most regular. **Video Bandwidth Index:** The video bandwidth index is a good indicator of the monitor's ability to display accurately at a high resolution. An index of 100 percent is the perfect score. **High-Contrast Step Streaking:** We use DisplayMate's High-Contrast Step Streaking test to observe the "streaking" effects that can occur when there are large changes in intensity in adjacent parts of the screen. **White- and Black-Level Shift:** The White-Level Shift and Black-Level Shift screens in the DisplayMate tests indicate whether the white and black levels are affected by the image on the screen. **APL Gray-Level Shift:** Using the DisplayMate tests, we look for the shift in gray scale when there is an abrupt change in average picture level (APL).—Analysis written by S. Jae Yang and Jeff Sacilotto

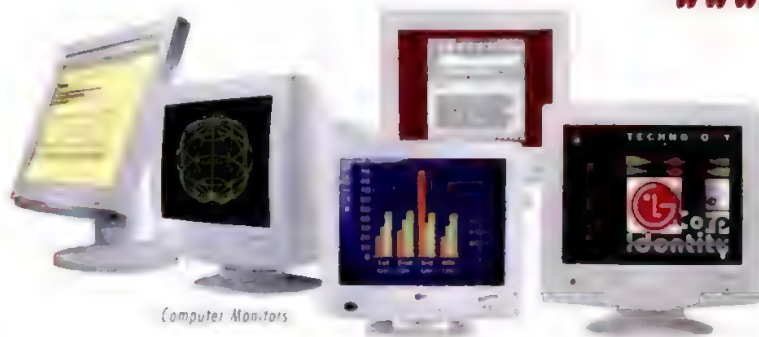
Pass X Fail															
▲ High scores are best.															
▼ Low scores are best.															
Bold type denotes first place.															
PC denotes Editors' Choice.															
Rank		Contrast Ratio ▲	Horizontal MTF (%) ▲	Vertical MTF (%) ▲	Screen Nonuniformity (%) ▼	Horizontal Nonlinearity (mm) ▼	Vertical Nonlinearity (mm) ▼	Focus (score) ▲	Internal Geometry	Screen Regulation (score) ▲	Video Bandwidth Index (%) ▲	High-Contrast Step Streaking (failures) ▼	White-Level Shift	Black-Level Shift	APL Gray-Level Shift
1	PC MAG Innovision 800v	170:1	72	58	5	0.1	0.5	3	✓	3	82	1	✓	✓	✓
2	PC LG Studioworks 995E	275:1	58	88	15	0.1	0.0	2	✓	2	82	1	✓	✓	✓
3	EIZO Naneo FlexScan FX-D7	176:1	65	72	3	0.4	0.2	3	✓	4	84	0	✓	✓	✓
3	Hansol 900P	229:1	83	74	14	0.5	0.0	2	✓	2	88	3	✓	✓	✓
3	IBM G96	250:1	86	88	11	0.3	0.2	2	✗	3	89	2	✓	✓	✓
6	Cornerstone P1400	178:1	85	66	6	0.1	0.1	2	✓	2	84	3	✓	✓	✓
7	PlusOne DecaView G400	242:1	84	75	16	0.3	0.2	2	✓	2	87	3	✓	✓	✓
8	Argon Pro T996	220:1	70	74	15	0.3	0.2	2	✓	3	88	2	✓	✓	✗
9	Optique V95	175:1	69	63	3	0.4	0.3	2	✓	4	73	0	✓	✓	✓
10	Princeton EO900	169:1	83	70	6	0.1	0.2	2	✓	3	90	1	✓	✓	✗
11	Philips 109B	224:1	69	83	23	0.1	0.0	2	✓	3	75	3	✓	✓	✓
12	Envision AOC Spectrum 9GLRS	150:1	72	72	8	0.4	0.1	2	✗	2	80	1	✓	✓	✗
13	ADI MicroScan G68	177:1	65	67	4	0.3	0.5	2	✓	3	84	1	✓	✗	✓
14	Panasonic PanaSync SL90	178:1	64	66	2	0.3	0.0	2	✗	3	85	3	✓	✓	✓
—	AcerView 99SL	170:1	71	53	9	0.1	0.1	3	✓	2	73	2	✓	✓	✗
—	Compaq S900	246:1	87	52	10	0.2	0.0	2	✗	3	78	1	✓	✓	✓
—	CTX VL950S	168:1	83	81	5	0.2	0.0	2	✓	4	85	3	✗	✗	✓
—	Daytek Vista V19	168:1	56	51	8	0.6	0.3	2	✓	1	93	1	✓	✗	✓
—	Dell P991	181:1	60	43	5	0.0	0.0	3	✓	2	97	1	✓	✗	✓
—	HP 90	177:1	79	46	5	0.2	0.2	3	✗	4	79	1	✓	✗	✓
—	Hyundai DeluxScan P990	175:1	43	64	7	0.2	0.4	3	✗	3	90	3	✓	✗	✓
—	IBM P92	291:1	64	37	4	0.5	0.1	3	✗	3	84	0	✓	✓	✓
—	Iiyama VisionMaster 450	182:1	73	87	3	0.0	0.0	2	✓	4	88	0	✓	✓	✓
—	Iiyama VisionMaster Pro 450	180:1	36	37	3	0.1	0.0	3	✓	4	74	1	✓	✓	✓
—	MaxTech XT-9881	178:1	16	80	9	0.2	0.5	2	✓	2	78	2	✓	✓	✓
—	MGC-9107	265:1	41	44	15	0.2	0.2	1	✓	1	N/A	2	✓	✓	✗
—	Mitsubishi Diamond Pro 900u	248:1	70	40	16	0.5	0.0	3	✗	3	74	3	✓	✗	✓
—	NEC MultiSync FP950	180:1	42	34	5	0.0	0.0	3	✗	3	92	2	✓	✓	✓
—	Nokia 446Xpro	134:1	78	47	15	0.0	0.1	3	✓	4	N/A	2	✓	✓	✓
—	Nokia 446XS	180:1	39	54	4	0.3	0.0	2	✓	3	96	0	✓	✓	✗
—	Samsung SyncMaster 900p	247:1	70	65	16	0.7	0.0	2	✗	3	86	3	✓	✗	✓
—	Sceptre Dragon Eye D97A	161:1	65	56	5	0.4	0.0	2	✓	2	96	3	✗	✗	✗
—	Smile CA8919SL	177:1	15	77	3	0.3	0.0	2	✓	3	84	2	✓	✓	✗
—	Sony Multiscan CPD-420GS	188:1	52	39	3	0.4	0.2	3	✓	3	87	2	✓	✗	✓
—	Sony Multiscan GDM-F400	320:1	67	55	8	0.3	0.0	3	✗	3	83	3	✓	✗	✓
—	Tatung C9RZT	178:1	69	64	4	0.1	0.2	2	✓	2	81	3	✓	✓	✓
—	ViewSonic PT795	289:1	62	26	14	0.6	0.2	2	✗	4	87	2	✗	✗	✓

N/A—Not applicable. We were unable to measure the video bandwidth.



LG is TECHNOLOGY

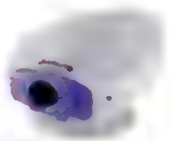
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The T996 scored well on both the business applications and graphics portions of the jury tests, though the images were not deemed quite as bright as on some of the other units. Screen geometry and uniformity were not quite as good as on some of the other finalists, but the T996 fared well on most of the other tests. (Argon Technologies Inc., Santa Fe Springs, CA; 877-840-5655; www.argontechnologies.com.)

OPTIQUEST V95

The Optquest V95 comes aggressively priced at \$380 and has a 0.23-mm horizontal dot pitch. The digital controls provide access to a good assortment of image adjustments, including many screen geometry controls.

The jury rated this monitor just shy of the top for the business applications. The DisplayMate tests indicated that the screen geometry was a bit more off-target than with many of the others in the final 14, but its image-size regulation was excellent. The SuperSpot results indicated a contrast ratio in the lower half of the



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www.displaymate.com

Home to the same DisplayMate software that we use for our monitor testing at PC Magazine Labs, www.displaymate.com provides all the latest information on the test site that has become a near-standard in the industry.

field but showed excellent image uniformity. (Optquest, Walnut Creek, CA; 800-843-6784; www.optquest.com.)

PRINCETON EO900

The Princeton EO900 targets high-end installations, including CAD/CAM, graphic arts, and desktop publishing, but its \$530 street price should make it appealing for general business applications as well. The screen has a 0.23-mm horizontal dot pitch, and the company provides 48-hour advance replacement during the first year of the three-year warranty.

The jury found the monitor nearly perfect for general business applications but a bit weak for graphics applications, because of a display that was not quite as bright as some of the others. The SuperSpot results indicated good brightness uniformity, though the contrast was a bit low. The DisplayMate tests yielded good screen geometry and bandwidth index measurements. (Princeton Graphics Systems Inc., Santa Ana, CA; 800-747-6249; www.princetongraphics.com.)



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Horizontal frequency 30-115khz

VisionMaster Pro 510 - \$1229 ESP
Resolution 2048 x 1536 @ 80hz
AG pitch 0.25mm center
Horizontal frequency 30-130khz

	CRT Monitor Model/ Viewable Area	TCO	Dot Pitch/ CRT Type	Max. Horizontal Scan Rate	Max. Resolution	Est. Street Price
22"	VisionMaster Pro 510 (20.0" VIS)	TCO '99	0.25mm/AG	130khz	2048 x 1536@80hz	\$1229
21"	VisionMaster Pro 502 (19.5" VIS)	TCO '95	0.28mm/AG	110khz	1800 x 1440@75hz	\$999
	VisionMaster Pro 501 (19.5" VIS)	TCO '95	0.28mm/AG	96khz	1600 x 1200@75hz	\$939
	VisionMaster 502 (19.5" VIS)	TCO '95	0.22mm/H	110khz	1800 x 1440@75hz	\$999
19"	VisionMaster Pro 450 (18.0" VIS)	TCO '99	0.25mm/AG	115khz	1800 x 1440@80hz	\$699
	VisionMaster 450 (18.0" VIS)	TCO '95	0.22mm/H	102khz	1600 x 1200@80hz	\$559
17"	VisionMaster Pro 410 (16.0" VIS)	TCO '99	0.25mm/AG	96khz	1600 x 1200@75hz	\$469
	VisionMaster Pro 400 (16.0" VIS)	TCO '95	0.25mm/AG	96khz	1600 x 1200@75hz	\$399
	VisionMaster 400 (16.0" VIS)	TCO '95	0.26mm/dp	96khz	1600 x 1200@75hz	\$379
	3702BT (16.0" VIS)	TCO '95	0.28mm/dp	96khz	1280 x 1024@85hz	\$299
16"	VisionMaster 350 (13.7" VIS)	MPR-II	0.26mm/dp	69khz	1280 x 1024@65hz	\$219
	TFT/LCD Monitor Model	TCO	Pixel Pitch	Max. Horizontal Scan Rate	Max. Resolution	Est. Street Price
14.1"	Pro Lite 38a (with OSD)	TCO '95	0.297mm	62.5khz	1024 x 768@75hz	\$839
15.0"	Pro Lite 38a (with OSD)	TCO '95	0.297mm	62.5khz	1024 x 768@75hz	\$1079
	Pro Lite 38b (with OSD, USB & Speaker)	TCO '95	0.297mm	62.5khz	1024 x 768@75hz	\$1129
16.4"	Pro Lite 38a (with OSD, USB & Speaker)	TCO '99	0.2385mm	80khz	1280 x 1024@75hz	\$1999
18.1"	Pro Lite 48a (with OSD, USB & Speaker)	TCO '99	0.2805mm	80khz	1280 x 1024@75hz	\$3329

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HARDWARE
19-Inch Monitors

PHILIPS 109B

The Philips 109B, a Business Series monitor, has a 0.22-mm horizontal dot pitch and a skinny case, only 16.5 inches deep. It also has a skinny price for a top brand: \$480. The interface is easy to use, with standard controls separate from some of the more advanced choices.

The jury rated it a bit below the top for business applications and strong for graphic arts. The DisplayMate tests indicated excellent screen geometry, but the bandwidth index was weak. The SuperSpot tests revealed good contrast but weak brightness uniformity. (Philips Consumer Electronics, Atlanta, GA; 800-531-0039; www.pcstuff.philips.com.)

ENVISION AOC SPECTRUM 9GLRS

Some users will like the handy jog wheel on the Envision AOC Spectrum 9GLRS, but the most attention-grabbing feature is the \$320 street price—less than half that of some others in the final 14. Positioned as a general-purpose monitor, it should fit in either home or office budgets.

The jury judged it a bit weak for word

processing—smaller fonts tended to blur—even though it has a 0.23-mm horizontal dot pitch. The 9GLRS was rated better for graphics applications, near the top of the finalists. DisplayMate tests indicated that the screen geometry was about average, and it was a little weak on screen image size regulation. On the SuperSpot tests, the monitor was weak on contrast but had a good uniformity score. (Envision Peripherals Inc., Fremont, CA; 888-838-6388; www.epius.com.)

ADI MICROSCAN G66

ADI's G Series monitors are positioned for CAD/CAM, advanced graphics, and desktop publishing applications. The ADI MicroScan G66 has a 0.23-mm horizontal dot pitch and a street price of \$490. The monitor is just 16.5 inches deep, and the cable connections are underneath, so you can push the unit right up against a wall.

In spite of its high-end positioning, the jury saw this unit as best suited for general business applications. For graphics use, they ranked the unit way below the other finalists in color and brightness. Super-

Spot tests indicated that the monitor had good brightness uniformity but a below-average contrast ratio. On the DisplayMate tests, the screen geometry was below average, though the monitor did have a good bandwidth index score. (ADI Systems Inc., San Jose, CA; 408-944-0100; www.adiusa.com.)

PANASONIC PANASYNC SL90

The new short-neck design on the Panasonic PanaSync SL90 enabled its engineers to squeeze the monitor into a case just 16.3 inches deep—smaller than many 17-inch models. With a 0.22-mm horizontal dot pitch, the monitor carries a premium price—\$650—compared with most of the other finalists.

The jury rated the SL90 weak for general business applications but strong for graphic arts. The DisplayMate tests indicated that the unit had good screen geometry and bandwidth. The SuperSpot tests showed average contrast but excellent image uniformity. (Panasonic Document Imaging Co.; Secaucus, NJ; 800-742-8086; www.panasonic.com/alive.) **PC**

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The Virtual Office

By Larry Seltzer

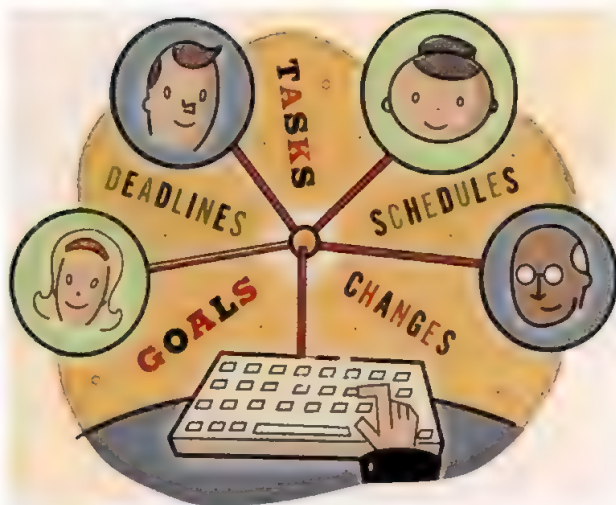
Like your real workplace, a virtual office surrounds you and your team with the tools for helping you get the job done. All you need to get started is Internet access, a Web browser, and a credit card. Here are some of the features you'll find in these packages.



Publishing and Document Management

An Internet- or intranet-based virtual office doubles as a virtual filing cabinet. Store documents that you always need at hand—product brochures, sales reports, or HR policies. Some services even let team members create the documents together. If a document requires approval from several team members, you can create a routing list. And a version-control feature helps you keep tabs on who's changing what. The service will even notify you at log-on when documents have been altered.

Software



Project management

Traditional project management software is great for handling complex projects with concrete tasks and goals. But that's not how most projects work in the real world. The composition of the team changes, goals get refined, and deadlines shift as other tasks get in the way. The better virtual-office solutions provide a basic set of tools that are well suited for these real-world undertakings. You can assign tasks, schedule meetings, and set milestones.



Access Anywhere

Because the virtual office exists on a secure server on the Internet, all members of the team can access the project from any PC that has a Web browser and Internet access, whether they're at the office, at home, or on the road. Some of these packages also let you copy part of a project to your hard disk, so you can work on it when you're not connected and later get back in sync with the rest of the team.

Chances are, you work within a small team. Maybe it's your whole office, or a department within a larger office, or maybe the team constantly changes with each new assignment. Your projects typically involve exchanging files back and forth and endless e-mail threads. You're never sure if the note you just received was a response to the message you just sent or someone else's message from three days ago. The fact is, e-mail just wasn't meant for *managing* a project.

Wouldn't it be great if you could have a place where you could keep everything related to a project? You could ask your IS people for help (if you have an IS department), but they'd probably snicker, "Sure. Right after we're done tackling the Year 3000 problem." And even if they did set something up for you, they'd never let your outside consultants into their intranet.

As usual these days, the Web presents a solution. In this story, we review four public, Web-based services for building private, secure Web sites where a team, or even an entire company, can collaborate on projects. For as little as \$13 per user per month, you get document sharing, project management, task tracking, discussion forums, calendars, and real-time communication capabilities.

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Generally, these four teamware services fall into two categories. The first type targets companies that want a corporate portal or intranet. These services, namely HotOffice and InTandem, can be used on a per-project basis or as an entirely outsourced network infrastructure. You can set up a home page that shows company news, messages to read, and a shared calendar. From this site, you might fol-

low links to other sites, work on documents with other users, or contact team members.

The second kind of service focuses solely on projects. eRoom gives you a single space for tracking all of your projects on an ongoing basis. On the other hand, you'll likely set up a separate Lotus QuickPlace for each project.

With all these services, you can bring a team together on the Web without having any IS infrastructure of your own. And since your network doesn't have to host them, you can invite in anyone you want, such as outside consultants, without compromising your LAN's security.

If you're expecting all the functionality of groupware packages, such as Lotus Domino and Microsoft Exchange Server, or project management tools like Microsoft Project, you'll be disappointed. Today, most accept sacrificing some power for universal, browser-based access. Still, to increase their capabilities, all of the services except InTandem include some functions requiring a plug-in or ActiveX control that supports only Windows 9x or Windows NT. eRoom and HotOffice users have partial functionality with just a browser on any platform.

These services have three core functions in common: document management (a place to store and manage documents), threaded discussions (a place to exchange ideas), and project management tools (a

shared calendar or task list for recording deadlines and milestones).

Document management includes check-in and check-out, versioning, and routing. Users can upload external data files, such as Microsoft Word documents and Excel spreadsheets, to areas on the site where other users can share them. The better products let users lock documents when modifying them and track the different versions. QuickPlace even lets you define an approval cycle that documents must pass through before being finalized.

To facilitate the exchange of ideas, all of the services support *threaded discussions*, those lists of messages that use indenting to show who is responding to whom. eRoom also lets you poll members to help resolve those discussions. Both eRoom and HotOffice let you conduct real-time chats, and HotOffice even integrates with Microsoft NetMeeting.

Project management with these products doesn't mean Gantt charts, PERT charts, or histograms. Basically, you schedule meeting times, maintain a list of shared events, and assign tasks to team members with deadlines. Despite the simplicity of these demands, we still found all of the programs somewhat lacking.

For instance, eRoom and HotOffice have no notion of task durations or scheduling conflicts. Using QuickPlace's forms-design interface, you can create a basic task list and tie it to the calendar, but as project management goes this is only rudimentary. Fortunately, these limitations don't mar the service's usefulness.

Once you unite your project's components into a teamware product, you will want to access it from anywhere, even without a live Net connection. Only QuickPlace lets you replicate your entire project to your hard disk and synchronize when you're back on the Net.

You can generally set very detailed access rights with these services, restricting who can access certain areas of the service and who can edit specific documents. But disappointingly, we found several potential security problems. None of the services log the user out after a period

Editors' Choice

• HotOffice 2.0



Such a deal! If you have Internet access and a few dollars, you can build your team a home on the Web.

Each of the services in our story carves out its own niche in this teamware market, but HotOffice 2.0 has the most complete set of tools. And at \$12.95 per user per month, it's the least expensive of the lot.

We couldn't ask for the HotOffice setup to be any more straightforward. Once the site is up and running, we had everything we needed to coordinate our day around our HotOffice. The service includes project-related tools: a document library for storing files, discussions for exchanging ideas, and a shared calendar for tracking meetings and tasks. Plus it gives each team member and the team as a whole a home page, contact manager, e-mail account and real-time chat capabilities. HotOffice has links to third-party

of inactivity, and only HotOffice provides an explicit Sign Off button. Automatic logoff should at least be a configuration option, since teamware products can be used in public situations, such as at kiosks and airports. Aside from HotOffice, the services log you out of your connection only when you quit the browser.

The idea of forming offices such as these is a wonderful one with dazzling potential. These services make it possible to create a framework, quickly and cheaply, for collaborations among disparate users that were impractical in the past. For instance, in this age of "coopetition," two competing companies often need to work together, but neither is willing to give the other access to its in-house network facilities. The speed and low cost of teamware products permit setting up the

business services, such as office supply stores and research sites.

HotOffice has a shortcoming, though, in managing projects. It spreads pieces of your project throughout the site, and you find yourself hopping from tab to tab. Instinctive Technology's eRoom, on the other hand, provides an easy-to-navigate hierarchy for all your projects and includes a polling feature to help you reach a consensus among team members.

Also notable is QuickPlace, Lotus Development's Corp's latest venture into the teamware market. It has some rough edges but you can easily create a virtual office with it. And besides having basic workflow tools and a custom forms designer, it's the only service in our roundup that lets you take your whole project with you off-line.

equivalent of a department's intranet without involving an organization's IS department. Using an external service also has the advantage of off-loading the backup and other maintenance chores to the service.

Despite the holes in these services, they have clear value and potential. They are inexpensive and can be useful home pages for projects and teams, even if the users resort to other software to fill in the gaps in functionality. In the future, expect the services themselves to fill in these gaps, with both horizontally and vertically oriented tools. You might see such sites with better hooks for third-party applications, as well as sites designed for ad-hoc teams of Web developers, scientists, or magazine publishers. You'll see partnerships between these sites and others, hosting vertically oriented applications. And given the pricing precedents set by this first generation of service, you'll probably end up trying them.



Our Contributors: LARRY SELTZER is a frequent contributor to *PC Magazine*. MATT KRAMER is a freelance writer. Senior associate editor JOHN MORRIS and PC Magazine Labs project leader DIANE JECKER were in charge of this story.

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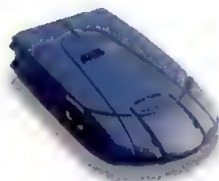


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Our test team consisted of six members with different access rights. We planned a project and participated in setting up group schedules, project tasks, and group chats. We posted discussions and related project documents for collaboration among team members.

Easy setup is paramount for this class of services. For **setup and administration**, we rate how easily an administrator can set up a project and add users, modify user properties and the site's structure, and monitor usage.

Under **communication**, we evaluate the service's ability to foster interaction between team members by providing threaded and searchable bulletin boards, voting forums, mail integration, notification of changes, and real-time chat and conferencing.

We observe the service's **project management** ability, including assigning roles and tasks to the different team members, establish-

ing milestones for the project, and giving status reports.

The service's abilities to maintain group appointments, check for conflicts, and provide varied calendar views fall under **information management**. Also, we look at the ability to maintain shared contacts and synchronize with standard PIM applications, such as Microsoft Outlook.

For sharing ideas and documents, a collaborative environment is important. Under **document management**, we see whether the service provides a document checkout feature, maintains versions of edited documents, and implements a document review cycle.

For **off-line functionality** we look at the user's ability to work while off the network and synchronize changes after reconnecting.

Under **security**, we evaluate the service's level of detail in assigning access rights to users and projects. Related factors include the range of rights assignable, whether browser timeout is implemented, and whether the vendor employs some form of encryption.

	Setup and administration	Communication	Project management	Information management	Document management	Off-line functionality	Security
eRoom 4.0	Fair	Good	Good	Fair	Good	Fair	Good
HotOffice 2.0	Good	Excellent	Good	Good	Excellent	Poor	Fair
InTandem 3.6	Fair	Fair	Fair	Good	Fair	Poor	Poor
QuickPlace 1.0	Good	Fair	Good	Fair	Good	Excellent	Fair

eRoom 4.0

Starts at \$25 list per user per month. Instinctive Technology Inc., Cambridge, MA; 617-497-6300; www.instinctive.com.

● If you and your coworkers are constantly juggling multiple projects, take a close look at eRoom, from Instinctive Technology. eRoom is available as a Web service or as software for creating self-hosted sites. A very usable product, it has some of the strongest collaboration tools in this review, as well as limited off-line capabilities. You will find many of its other features, such as contact and to-do lists, adequate for small projects, though not nearly as robust as those in HotOffice.

eRoom is available directly from Instinctive and through resellers, a list of which can be found on Instinctive's Web site. Instinctive charges \$25 per user per month, with no other fees. Discounts are available for large groups and reseller fees vary. The amount of hand-holding you get for setting up an eRoom will vary by reseller. Some will create user accounts for you; others may give you only a URL and a license.

eRoom has a browser-based environment that in many ways mimics Windows Explorer. This interface, available only through a rather large plug-in (9.8MB), makes eRoom easy to use. You can access eRoom without the plug-in, but the HTML interface doesn't have as much

functionality as the full version.

Like Explorer, eRoom presents a hierarchical set of folders and objects within them. A top-level folder typically represents a distinct project. The objects inside it can be Windows objects like Microsoft Word documents, or they can be threaded discussions, polls (as in a

group to make decisions. The coordinator can see who voted for what, and members have the option to change their votes.

eRoom's document management can't enforce routing rules for document workflow as QuickPlace's can. But you can arrange for specific users to be notified when a document changes. Also, eRoom

provides custom fields, so you can mark documents as "approved," "draft," and so on. With its version-tracking facility, anyone can view any version of a document through the editing process.

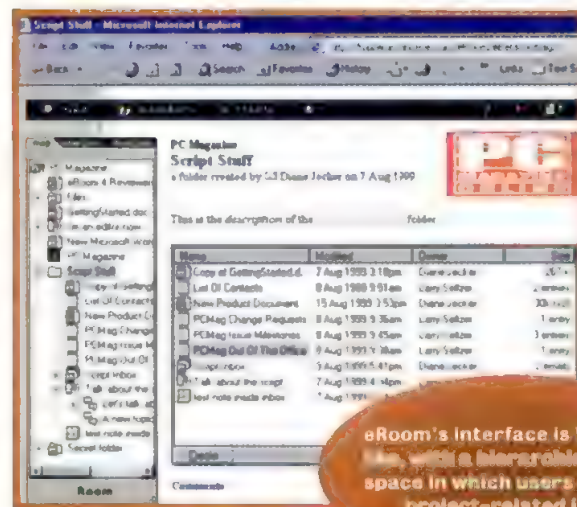
eRoom also has an excellent text chatting feature called the Intercom. Better implemented than in other products, this features lets

you search eRoom for items specifically by date modified and owner.

eRoom has a few drawbacks.

You can edit documents

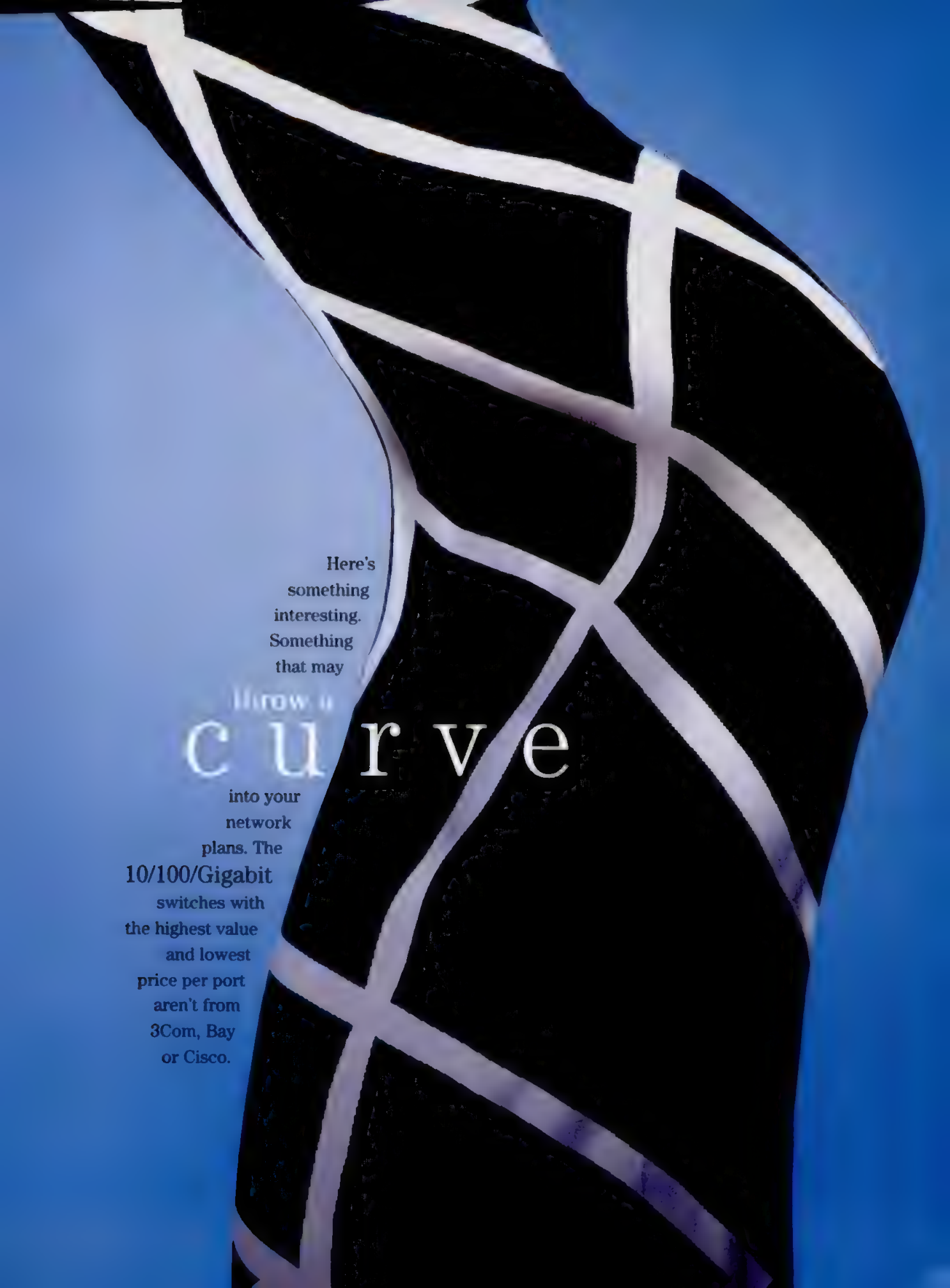
off-line, but the rest of eRoom's features require a live connection to the site. Unlike when using QuickPlace's global replication approach, you have to know the names of documents buried in directories. eRoom also lacks a good calendar and contact database. It has a linear event



eRoom's interface is Windows-like, with a hierarchical workspace in which users can place project-related items.

vote), or a list of tasks. Also, you can configure an object as an in-box. You don't get an e-mail account, but you can set up an e-mail in-box at any point in the hierarchy, instructing eRoom to retrieve and read the contents of any POP3 account.

The polls, unique among the products here, represent a structured way for a



Here's
something
interesting.
Something
that may

throw in
curve

into your
network
plans. The
10/100/Gigabit
switches with
the highest value
and lowest
price per port
aren't from
3Com, Bay
or Cisco.



They're from
Hewlett-Packard.

HP ProCurve

L2 and L3
10/100/Gigabit
switches give you more
for your money.
All ports are switched.
All ports autosensing.
All industry standard.
All at a price per port up
to 50% less than other
major network companies.

HP made 10/100
switching very affordable.
Now we're doing the
same with Gigabit. To ready
your network for
bandwidth hungry applications
like e-mail, internet access,
voice over IP (VoIP) and video.

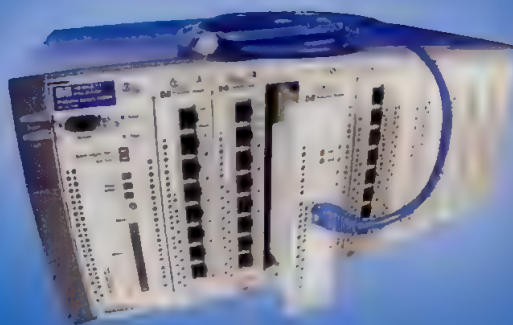
And HP introduces
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Switch 4000M
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3Com SuperStack II 3300 \$156 per port
Bay Networks 450T \$173 per port
Cisco 3524XL \$156 per port
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should go to our
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with a price quote.



list and a contact list that don't measure up to those of other products in this story, like HotOffice. Also, it has confusing administrative features. For example, the interface has a dialog screen that lists groups, where you can scan through members and add new ones, but you can't do much more than that. You can't even delete groups.

Without better mail, calendar integration, and contact management, you might not choose eRoom as your main home on the Web. But when it comes down to working together and getting things done, eRoom can pull you through.

HotOffice 2.0

Starts at \$12.95 list per user per month. HotOffice Technologies Inc., Boca Raton, FL; 888-446-8633, 561-995-5990; www.hotoffice.com.



HotOffice wants to be the center of your workday, and for \$12.95 per user per month it handles the task admirably. Through its well-designed interface, you can quickly check what's on your day's agenda, communicate with others inside and out of your HotOffice, find the latest copy of your important documents, and manage projects.

Like InTandem, HotOffice goes beyond projects to provide your team a home on the Internet. The service doesn't give you one place to go to access your project; instead, it distributes project details among its main areas: My Desk, Documents, Communications, Search, Management, Business, and Help. Uniquely, the Business section contains links to several useful third-party business services.

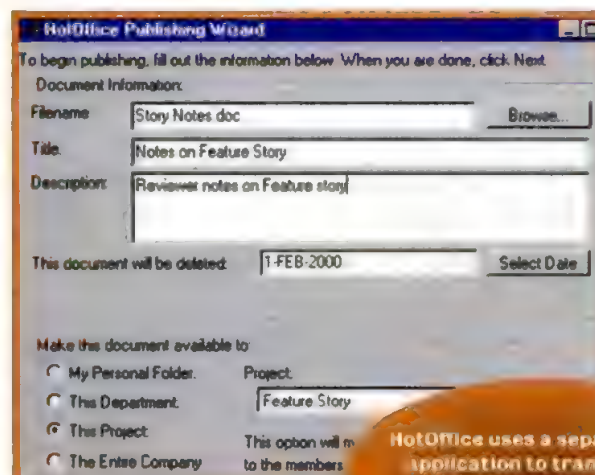
You create a HotOffice site through a series of forms posted on the company's Web site. The first time you enter your site, a wizard takes you through configuring users and projects.

HotOffice is also unique in that it gives each team member an e-mail account. You can configure the account to read mail from other POP3 accounts,

in order to consolidate your mail access within HotOffice. From anywhere, you can quickly jump to your new mail, the calendar, bulletin board postings, and documents.

The mail client in HotOffice has useful features, such as folders, but it supports only plain text. In the Communications area, you can stage real-time chats involving two or more people, and the service integrates with Microsoft's NetMeeting for application sharing and shared whiteboards.

From the Documents area, you can upload, view, and edit files. To upload files, you must install the full HotOffice Starter Kit on your computer. HotOffice's HTML viewers, which did well on our tests, let you preview in the browser many types of documents—such as Corel WordPerfect, Lotus 1-2-3, and Microsoft Office. From Microsoft Office 97 and 2000 you can open and save docu-



ments to your HotOffice site. When you are editing a document, HotOffice will lock it so the other team members can't modify it. The software will also track who edited a file last. You must always have a live connection to HotOffice; the service lacks any off-line capabilities.

The administrator of the team's HotOffice can manage user security on a group or individual basis, assigning users to departments and projects and restricting documents to such groups. The administrator can even assign those outside your company very limited views into your HotOffice.

The My Desk area provides a reasonably full-featured calendar and contact

database. The group calendar lets you schedule meetings, keep track of your team members' schedules, and confirm everyone's availability instantly. With the contact manager, you can store names, telephone numbers, e-mail addresses, and more for the whole team to share.

HotOffice's lack of off-line capabilities is its only significant limitation. But its low price and its wealth of basic features could give you and your team just what you need to get started with a virtual office.

InTandem 3.6

Starts at \$19 list per user per month. IntraActive Inc., Washington, D.C.; 800-515-2432, 202-822-3999; www.intraactive.com.

● True to the company name, IntraActive's Web-based collaboration service, InTandem, focuses on interaction and collaboration between teams. But its limited project management capabilities may

relegate it to being more of an online watercooler than an online war room.

InTandem can get your team started quickly, using the built-in modules to have discussions, assign various tasks, maintain calendars, manage address books, and share documents. The well laid-out interface lets you navigate directly to a specific module func-

tion, such as adding an appointment. But there's little integration among the different service modules.

You must contact IntraActive by phone to set up an InTandem site. Once the company completes the initial site and turns it over to you for configuration, an administrator can create users and give them access rights to individual modules. InTandem did not automatically send an e-mail notifying users of their new accounts and passwords, as HotOffice did. Instead, while logged in as the administrator, we had to send out e-mails manually to invite people to become team members. InTandem is also available for self-hosting on a private intranet.

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Discussion forums and news bulletin boards form InTandem's communications features. The forums are somewhat limited; you cannot easily attach files to them except through a convoluted system for assigning aliases. In the News section, you can post memos, articles, press releases, and more. To do this you just have to fill out a form.

The document management functions reside in the Files section and are adequate for small teams. When you upload a new version of a file, InTandem does not overwrite the original. The system keeps track of different versions when users return files, but there's no file locking or check-in and check-out.

InTandem's calendar emphasizes group meetings. To make an appointment with an individual, just select that person from the contact list; the contact manager holds all the standard information.

InTandem limits its project management to assigning and categorizing tasks. The search function lets you look for common elements across all of the service modules, but the software lacks some of the rich project tools found in the other services, which let you assign files and discussions to a project and even vote as part of project work.

Other downsides include InTandem's weak security. The connection to the service never times out but remains active as long as your browser is open. This presents a potential security hole, particularly when you're logging in from a public browser. Also, users have to be disciplined enough to check the Web site frequently, since InTandem doesn't notify you of new entries. The only time the service sends e-mail notifications is when a user schedules a new appointment.

If your business does not require project management, has just basic collaboration needs, and wants a simple site to keep employees informed, then InTandem may fit your organizational style.

QuickPlace 1.0

Price set by reseller. Lotus Development Corp., Cambridge, MA; 800-575-6887, 617-577-8500; www.quickplace.com.

● Most of the other services in this roundup focus on creating a single place for users to manage all of their projects, but QuickPlace users can create a sepa-

MS OFFICE 2000'S TEAM TOOLS

Many of the collaboration tools discussed in our main story might already be sitting on your system if you use Microsoft Office 2000. Released in June, this most recent version of Office includes a host of team-collaboration features designed to be used primarily on corporate intranets.

The Web features in Office 2000 are designed to alleviate the "Webmaster bottleneck" in many companies and help teams use intranets to collaborate on projects instead. On the most basic level, Office 2000 lets you do many of the same tasks that you would do with a regular file server—save, view, and edit documents. Also, with Office 2000 it is nearly as easy to navigate and manage Web servers as it is with local and network drives and folders.

When paired with the right Microsoft server-side technology, Office 2000 lets team members insert comments into documents on Web servers from within a standard Office application or Web browser

(either Internet Explorer or Netscape Navigator). You can also subscribe to documents and receive notification via e-mail whenever they are modified. If your Web server is running Microsoft Index Server, you can search for documents based on their file properties, and the server will automatically generate a start page and a navigation page with links to all documents currently residing on the server.

The editing and publishing features work with either Microsoft Office Server Extensions (OSE)—a set of Web applications based on FrontPage 2000 Server Extensions, Active Server Pages, and ActiveX Data Objects—or Web servers that support the WebDAV (Distributed Authoring and Versioning) protocol. The discussion and subscription features require OSE. Included in both Office Professional (Disk 1) and Office Premium (Disk 3), OSE runs on Windows NT 4.0 with Personal Web Server 4.0 or Internet Information Server 4.0.

—John Morris

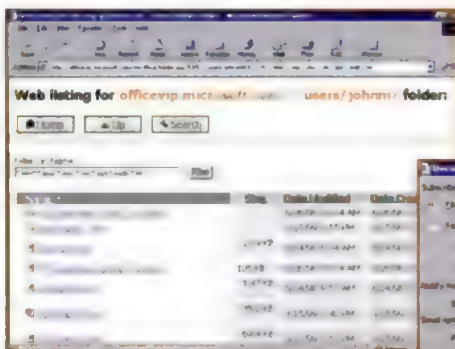
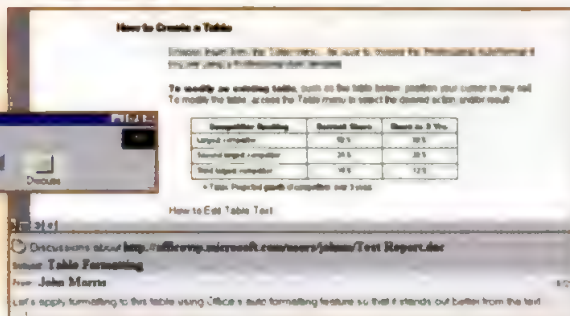


Web Publishing

Just as you would save any file, you can publish Office documents to Web servers in their binary Office file formats, rich text format (RTF), or HTML. Once saved to a Web server, these documents can be viewed, edited, and managed from IE or any Office applications. A set of COM (Common Object Model) components even lets you save charts, graphs, and tables in interactive formats that can be manipulated within IE.

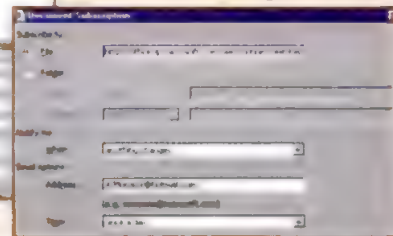
Web Discussions

Everyone on the team can be a critic with the Web Discussions feature. From an Office application or Web browser, you can add general comments about a document or insert annotations within the text. To view and edit comments, you use the new Discussions toolbar in IE5.



Subscriptions

Office 2000 can help you keep an eye on important documents. The Subscriptions feature lets you subscribe to particular documents and receive notification via e-mail whenever changes are made.





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*Figures assume 3.5 MBIC hardware, compressed 511KB MBSP for internal kit.

Other Teamware Products

PRODUCT	PRICE	URL	COMMENTS
OUTSOURCED TEAMWARE PRODUCTS			
docSpace Manager	\$50-\$60 list	www.docspace.com	Available in late September, docSpace Manager integrates with the rest of the docSpace family—Drive, a remote document management service, and Express, a courier service. Manager provides a highly secure environment for project-based file sharing and discussions.
eGroups Office	Free	www.egroups.com	Targeting small businesses, eGroups Office provides a calendar, e-mail, a contact database, an expense-reporting database, and a secure virtual office. eGroups focuses mainly on communication, so it lacks project and document management tools.
iNiku.com	Free	www.iniku.com	iNiku.com is a business portal that gives small businesses and independent professionals project management tools and a virtual workspace. Not only can you collaborate with people in your own company, the site helps you market your services and work with existing clients.
MemberSites	Free	www.membersites.com	In a secure Web site setting, groups can chat, share documents and pictures, keep contacts and a calendar, and publish newsletters. MemberSites will automatically send e-mail invitations; just enter the proper addresses of those you want in your group.
Netopia Virtual Office	Free	www.netopia.com	Virtual Office was one of the original teamware services. Netopia has since repositioned it as a tool for small businesses and independent professionals who want their own Web sites with e-mail and other communication tools.
3-2-1 Intranet!	\$9.95 list per user per month	www.iminet.com	A company of any size can use 3-2-1 Intranet! for employee interaction and for communications with customers. You can share files, schedule events, keep time sheets, and create surveys, reports, bulletin boards, and databases.
X-Collaboration.com	\$9.40 list per user per month, plus \$50 setup fee	www.x-collaboration.com	X-Collaboration.com incorporates aspects of real project management and lets you create compound documents stored in visual hierarchies. You can attach threaded mail discussions using external mail facilities.
Yahoo! Connected Office	Free	connected.clubs.yahoo.com/office	Connected Office provides workgroups with a shared calendar, a message board, live chat, a contact manager, and a photo album but no document management. A News area offers useful links, headline news, articles pertaining to small businesses, stock quotes, and more.
SELF-HOSTED TEAMWARE PRODUCTS			
involv Intranet	Varies according to client configuration	www.involv.net	This product is based on a set of simple collaboration tools for sharing calendars, files, discussions, and project tasks. Communication features include a pager, chat, and e-mail notification when new items are added to the involv team.
Livelink	Server and 100 users, \$125,000 list; each additional user, \$97	www.opentext.com	Touted as knowledge management for any size business, Livelink links all parts of your company together by shaping your intranet into one big Web site. Here, employees can publish, store, broadcast, and search for anything corporate-related.
Project Home Page 2.0 with Action Plan	Starts at \$32,495 list per server	www.netmosphere.com	Project Home Page lets you track your company's projects and resources through a browser. You can set access rights, and Netmosphere's Action Plan gives you Web-based project management tools like task assigning, e-mail task reminders, and status updates.
ReviewIt AEC	\$1,500 list per project	www.cubus.net	Developed for the architecture, engineering, and construction (AEC) industries, ReviewIt AEC is a project collaboration Internet application that lets you view and edit all CAD files and graphics files. It has messaging features, document management, and project monitoring.
TeamCenter	\$4,995 list per server	www.inovia.com	A Web-based project management service geared toward companies organized by teams, TeamCenter includes group discussions, and its Up-To-The-Second technology ensures that users always see the most current project data.
TeamLeader	Starts at \$750 list per server	www.keylogic.com	TeamLeader is designed to manage work processes. Users can build role-based work flows based on a team organizational chart, and TeamLeader will notify members when a key piece of the project is complete.

rate QuickPlace for each project. Combined with powerful off-line capabilities, this flexible approach might be the more conducive to the way many of us work. Unfortunately, the product's interface

can be slow and confusing.

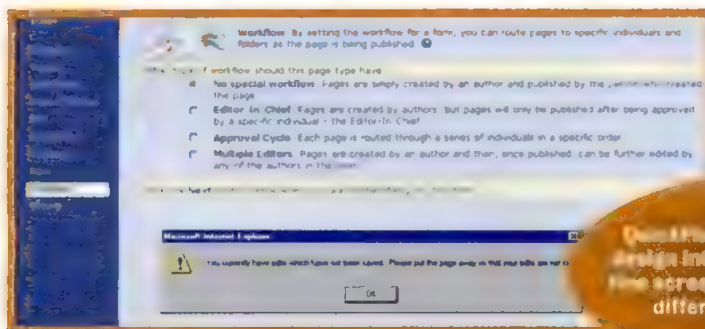
QuickPlace is a brand-new service, to be rented through Lotus partners. We tested it on Lotus's own demonstration site. Service provider Interliant plans to be

offering QuickPlace by the time you read this review for \$14.95 to \$19.95

per user per month, with a 150MB storage limit per project. America Online and IBM Workgroup Services plan to offer the service as well. Lotus also sells the QuickPlace server software for companies that want to host the service themselves.

In general, to create a QuickPlace you just need to provide some basic information: name, credit card number, a name for your site, and so on. There's no wizard to help you begin adding users, as there is with HotOffice. QuickPlace service providers may modify the installation routine, so your experience may vary.

QuickPlace tools include a shared calendar, threaded discussions, and



QuickPlace has a rich, browser-based design interface. It lets you create and edit all CAD files and graphics files. It has messaging features, document management, and project monitoring.

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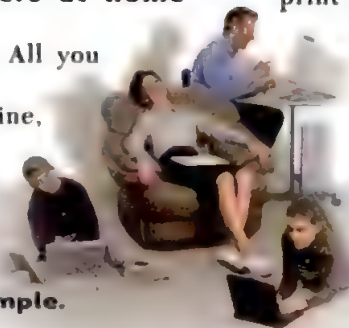
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by proxim

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SUMMARY OF FEATURES

Teamware

PC MAGAZINE
EDITORS' CHOICE

	eRoom 4.0	HotOffice 2.0	InTandem 3.6	QuickPlace 1.0
Price				
List price per user per month	Starts at \$25	Starts at \$12.95	Starts at \$20	Depends on service provider
Administration: create, delete, rename	☐	☒	☒	☒
Group alerts via e-mail	☒	☒	☐	☒
Works with Netscape 3.x-4.x	☒	☒	☒	☒
Works with Netscape 3.x-4.x	☐	☒	☒	☐
Requires plug-ins or helper controls	☒ (functionality available through browser)	☒ (star put-storing only)	☐	☐
Includes building tools for forms	☐	☐	☐	☒
Includes Web site for Web browser	☒	☒	☐	☒
Includes offline full functionality for mobile users	☐	☐	☐	☒
Includes a data archival tool	☒	☐	☒	☒ (user must download)
E-MAIL				
Offers Web-based e-mail for each team member	☐	☒	☐	☐
Integrates with standard Internet e-mail	☒	☒	☒	☒
MIME / S/MIME attachments	☒	☐	☐	☒
Unencoded attachments	☒	☒	☐	☒
Formatted text, graphics, and forms	☒	☐	☐	☒
DISCUSSION				
Supports unlimited users at 0 threaded discussion	☒	☐	☐	☒
Over 100,000 BUs can subscribe	☒	☐	☒	☐
User can search by date, topic	☒	☒	☐	☒
User can search by topic, user name	☒	☒	☐	☒
User can add links to discussions	☒	☐	☐	☒
CALENDARING AND SCHEDULING				
Calendar offers reminder alerts	☐	☒	☐	☐
Includes project scheduler	☐	☒	☒	☒
User can view scheduler by day, week, or month	☐	☒	☒	☒
User can view scheduler by user	☐	☒	☒	☐
Supports free scheduling	☐	☒	☒	☐
Searches for free time slots of invitees	☐	☒	☐	☐
REAL-TIME FEATURES				
Builds real-time text chat	☒	☒	☐	☐
Builds real-time audio and video	☐	☒	☐	☐
Supports third-party real-time communications	☒ **	☐	☐	☐
Supports chat for more than two users	☒	☒	☐	☐
DOCUMENT POSTING AND MANAGEMENT				
Administrator can assign access rights on folders and document levels	☒	☒	☐	☒
Views in MS Word, Excel, and PowerPoint	☐	☒	☐	☒
Users can add folders	☒	☒	☒	☒
Navigation of the main page	☒	☒	☐	☒
Tracking of document modifications	☒	☒	☒	☒
Public and private postings areas	☒	☒	☒	☒
Check-in and checkout	☒	☒	☐	☒
Versioning	☒	☒	☒	☒
Supports routing of documents	☒	☒	☐	☒
CONTACT MANAGEMENT				
Maintains group's contacts	☒	☒	☒	☐
Maintains personal contacts	☒	☒	☒	☐
Contact manager synchronization	Custom	None	None	None
ADDITIONAL SERVICES				
Internet search	☐	☒	☐	☐
Dictionary	☒	☐	☐	☐
Yellow Pages	☐	☒	☐	☐
Links to other business services	☐	☒	☐	☐
Travel guides	☐	☒	☐	☐

* Does not support publishing. ** User must import MS NetMeeting contact files into eRoom.

folders for documents and notes. No facilities for chat exist. Also, there's no contact database, but you can define one in the forms interface.

QuickPlace gives managers the ability to create customized forms; this is a feature the other reviewed products lack. The forms have numerous useful predefined data entry types, such as dates, times, and members' pop-up lists. Besides retrieving data from the user, the forms can be used to organize workflow for a document being uploaded to the server. For example, you could define an approval process for documents stating the order of authorization. As documents are submitted, the designated approvers would receive e-mail notifications with links to the appropriate pages.

The typical QuickPlace screen has four HTML frames. The bottom frame has the main buttons like OK, Cancel, and Publish for confirming data entered in the main frame of the page. In our experience, QuickPlace displayed the prior main page's buttons for several seconds after a new main page appeared. As a result, we frequently clicked buttons that did not correspond to the frame we were working on.

Also, unlike a typical Web site, QuickPlace often will not let you click away from a page without explicitly confirming or canceling forms. This is very unusual and disconcerting for a Web-based application.

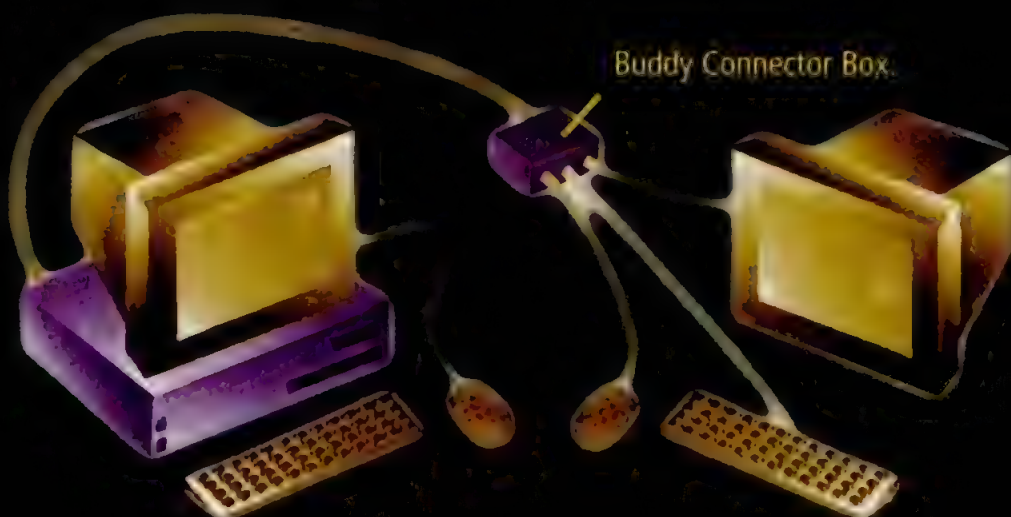
Each QuickPlace can have only one group calendar; so it's unlikely that you'll use a particular QuickPlace for more than one project at a time. But administrators can create Rooms, which are separate areas with separate security rules and potentially different design themes. Rooms provide a good mechanism for organizing subprojects within a project, and incoming mail can be rerouted to each room.

QuickPlace was the only virtual-office product we tested that lets you download your entire project to your hard disk so that you can work even when an Internet connection isn't available.

QuickPlace may be geared for handling one project at a time, but don't think that it's lightweight. Its powerful off-line features and highly customizable interface are unique among the services in this review. And because it is based on Lotus's Domino, QuickPlace has endless workgroup possibilities. **PC**

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3. Connect the 2nd user's monitor, keyboard and mouse to the Buddy Connector Box.

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Spreadsheet	✓	✓
E-mail	✓	✓
Database Application	✓	✓
Graphics File	✓	✓
Game	✓	✓
CD-ROM	✓	✓
Modem	✓	✓
Internet	✓	✓
Sound not available on Second PC.		



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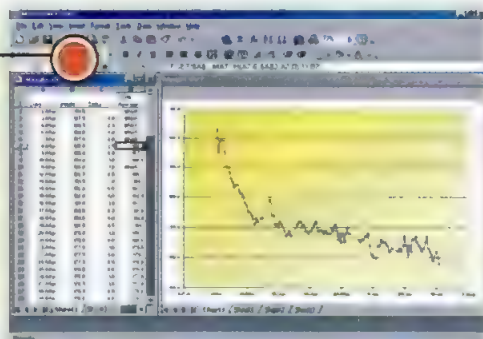
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solutions

FOR THE PC AND THE INTERNET

Find
a moving
average,
even when
you're
missing
some data
points.
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Improve
performance
with the new
Rambus
memory
system.
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HARDWARE 168

A new memory system called Rambus promises real performance advantages.

INTERNET 175

Microsoft Outlook can work the way you want it to work. Here's how.

OFFICE 183

Pull the information you need from your spreadsheet with Excel's Match function.

DESKTOP 187

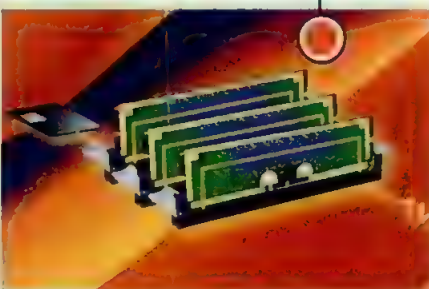
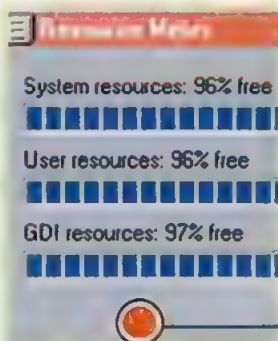
We show you how to take control of your system resources.

SMALL BUSINESS 191

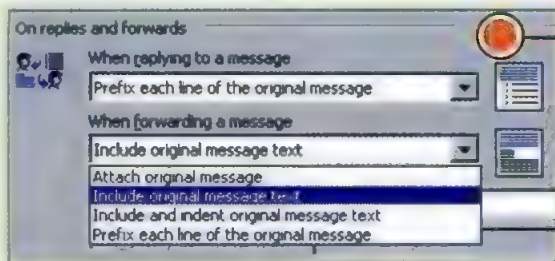
Installing a small-office network can be relatively easy. We explore several options.

UTILITIES 199

TreePrint displays your directory and file structure and lets you save or print the output.



Control your system resources
with Resource Meter's early-
warning system. *Page 188*



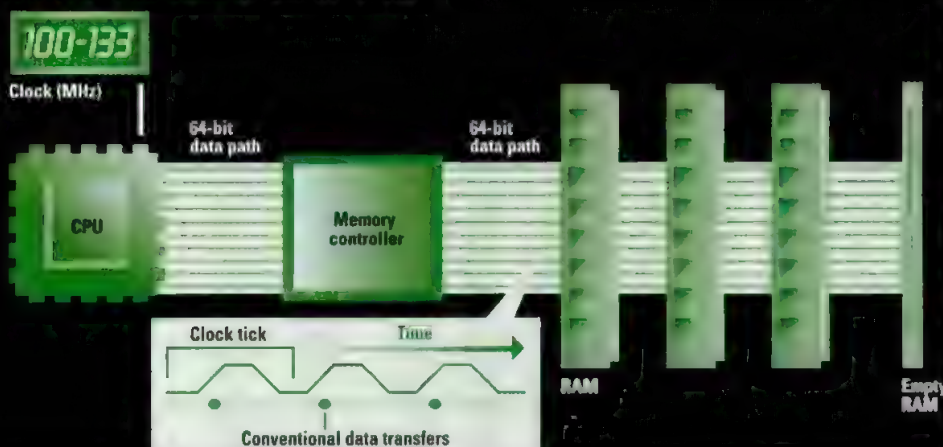
Customize
Microsoft
Outlook to make
your e-mail
conform to
your standards.
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You'll find all of the articles, examples, and code files in this section at Solutions online.
www.pcmag.com

Standard PC Memory Architecture Vs. Rambus

The current standard in PC memory architecture uses a 64-bit parallel path to the RAM chips and the same system clock as the rest of the system bus, usually 100 MHz or 133 MHz. Rambus uses a 16-bit serial connection but has a dedicated 400-MHz clock. Since Rambus technology allows data transfers on the uptick and the downtick of each beat of the clock (see the lower sections of the diagram), the clock rate is effectively doubled to 800 MHz.

CONVENTIONAL MEMORY ARCHITECTURE



Rambus: Battling the Bottleneck

Faster CPUs demand faster memory access: Rambus is ready to take up the slack.—by Alfred Poor

Even before the first IBM PC appeared on the market, a pitched battle raged between hardware and software. Just as soon as microcomputers increase the amount of data that they can process in a given length of time, software places demands that consume—or exceed—that processing capacity.

In the early days of the IBM PC and AT, the hardware solution was to run everything faster. The CPU, memory, and expansion bus all ran at the same speed, controlled by a single clock. But hardware designers soon learned that there were limits to how fast you could push components. The trend subsequently has been to break a computer's subsystems apart and run each at its own optimal speed. Processors have internal clock rates that are multiples of the system bus which they use to communicate with memory. Expansion buses run at their own ever-increasing speeds (and the Intel/Microsoft PC 99 system specification finally calls for the elimination of the legacy 16-bit ISA bus that limps along at 8 MHz).

System memory figures prominently in PC designers' quest for more speed. Using static RAM (SRAM) as a memory cache between the CPU and the system memory has helped speed memory access considerably. But processor speeds have reached rates where even the fastest cache can't provide enough help. New forms of DRAM have been developed—including EDO (Extended Data Out) RAM and Synchronous DRAM (SDRAM)—that could trans-

mit more data in high-speed bursts. Current systems typically use SDRAM capable of 100-MHz (10 ns) memory bus speeds—a far cry from the 8-MHz (125 ns) speed of the old IBM AT memory bus. System designers are looking for even more speed, however, which is why some are moving to the Direct Rambus DRAM (DRDRAM or RDRAM) design.

HOP ON THE RAMBUS

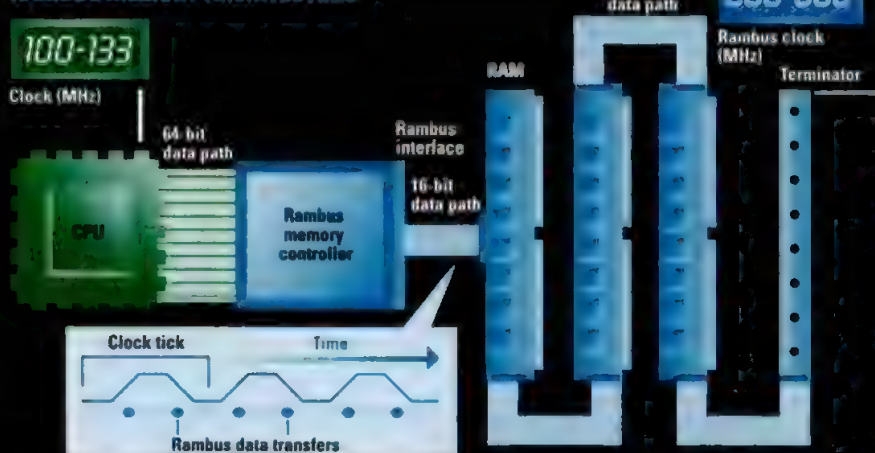
As its name implies, RDRAM places the memory on its own communications bus and a separate controller mediates between the CPU and the memory for data read and write commands. This is in contrast to a typical SDRAM configuration where the memory is connected to the same system bus as the CPU.

The difference between SDRAM and RDRAM can be likened to the difference between ISA bus devices and SCSI devices. Like SDRAM, the ISA bus devices are tied together on a single bus, and data can be written to and read from them by addressing the devices. In contrast, a SCSI device exists on a separate SCSI bus, and a SCSI controller handles the communications between the SCSI bus and the CPU. As with a SCSI bus, the Rambus components communicate at a rate independent of the other system components by using a dedicated clock.

SDRAM typically comes in 168-pin DIMM (Dual Inline Memory Module) configurations, which communicate with the system bus across a 64-bit-wide data path (8 bytes). PC100 memory

A faster clock and using both sides of the clock tick give Rambus big advantages.

RAMBUS MEMORY ARCHITECTURE



is designed for the latest system buses running at 100 MHz, giving this memory a maximum theoretical transfer rate of up to 800MB per second. (This assumes that the memory is able to make a transfer on every clock cycle, which can only hold for brief intervals).

In contrast, RDRAM uses a narrower, serial connection running at a higher speed. The data path is only 16 bits wide (2 bytes), with separate signal lines for row and column addresses, and for the local clock signal. The controlling clock runs at 400 MHz, but unlike other DRAM configurations, which can only affect data transfers on the fall of the clock signal, RDRAM can transfer on both the rise and fall of the clock ticks (see diagram).

This ability to get two transfers across per clock cycle leads some to describe the system as running at 800 MHz. No matter which way you choose to describe the clock speed, the memory is theoretically able to transfer 2 bytes of data 800 times a second, yielding a rate of 1.6 GB per second—twice that of the SDRAM. Systems that place high demands on memory access, such as workstations, can be designed with two separate Rambus channels, for a combined maximum throughput of up to 3.2 GB per second.

POWER TO THE PIPELINE

The real performance benefits of RDRAM come into play when things get busy. Because it uses separate lines for the row and column address data, and these are separate from the data lines, the memory can be performing a read or write transfer while receiving column data for a second operation, and at the same time be receiving row information for yet a third operation. In spite of the built-in delays between row, column, and data transfers for each individual read or

write operation, the simultaneous processing makes it possible to use the data lines on nearly every clock cycle.

This could translate into a performance advantage where today's operating systems and applications make simultaneous demands on processing resources. According to Kuljit Bains, platform architect for the Intel Workstation Products Group, the RDRAM protocol is able to achieve sustained transfer rates of up to 90 percent of the peak bandwidth. In contrast, SDRAM designs are only able to maintain a sustained rate of about 65 percent of peak.

GOOD THINGS IN FAMILIAR PACKAGES

The bad news is that you won't be able to simply unplug your existing SDRAM DIMMs and plug Rambus memory in its place. To take advantage of the new memory, your computer's motherboard must have a chip set that can support it, including the Rambus controller circuitry that provides the interface between the memory and system buses.

Direct Rambus memory exists on a separate bus and can deliver a 1.6-GBps peak data rate.

The good news is that it shouldn't be too difficult for system designers to make the transition. RDRAM is packaged in RIMMs (Rambus Inline Memory Module), which are roughly the same size and shape as DIMMs. According to some sources, the devices should have lower power consumption and reduced cooling requirements compared with DIMMs. One unfamiliar feature of RIMMs is a heat spreader, which serves to dissipate the heat generated by individual chips that are mounted more closely together than on a typical DIMM or SIMM configuration (see photo).

The modules can be designed with either 8 or 9 bits per byte. The extra bit can be used either for parity checking or error-correction

Easier Peripheral Connection

Connecting peripherals to the back of my PC is inconvenient. Is there any way to make it easier?

Chuck Lorange,
Ann Arbor, Michigan

The worst case is when your PC is in a fitted computer cabinet or desk. But even when your PC sits freely on a tabletop, plugging in peripherals, particularly those that you frequently connect and disconnect, can be a hassle.

USB peripherals can simplify your plug-in process. The best case is when you have a PC with one or more USB ports on the front (some HP Pavilion models even have a serial port on the front—nominally intended for connecting a digital camera, but also useful for PDAs or any other serial connection). With a front-mounted port, you can connect a peripheral easily. Some monitors and keyboards also have USB ports. Even if your USB ports are on the back of your PC, you can benefit by connecting a self-powered USB hub and placing it within convenient reach.—Bruce Brown

Improve Peripheral Performance

The PC world is all about change, but that doesn't mean your system is destined to perform the same forever. Hardware peripheral companies, particularly graphics and video adapter manufacturers, periodically release updated driver software that can fix problems, improve performance, enhance compatibility with other hardware peripherals and new software releases, and accommodate new operating-system versions. Most companies provide driver updates on their Web sites for free downloading—often with automatic installation programs. One way to be sure that you have the latest drivers is to check the manufacturer's Web sites for each of your peripherals. Some PC companies help by providing updated drivers on their own Web sites or links to peripheral manufacturers' sites. Microsoft's Windows Update Web site (<http://windowsupdate.microsoft.com>) provides updates to the operating system as well as a library of driver updates.—BB

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CISCO SYSTEMS



Triple Trouble

During the boot sequence and in DOS, my system's screen is not just doubled but tripled! As a result, I can't make changes in the BIOS setup. How can I fix this?

Robert Busby
via the Internet

Your monitor probably cannot synchronize with the signal from your graphics adapter. The DOS screen uses one of the standard VGA text modes, but your graphics card may have been configured to produce this mode at too high a refresh rate.

See if you can change the refresh rate. If not, check your monitor's adjustments to see if you can use the size and position controls to restore order to the image. You can also use a factory reset option to eliminate any stored configurations that might be causing the problem. If none of these work, try a different monitor. If it works without a problem, your monitor may need professional adjustment or repair.—AP

code (ECC) to automatically catch and correct errors. Modules contain up to eight chips per side. The first available chips are 64-Mbit and 128-Mbit versions, which create the possibility of making RIMMs with up to 128 MB and 256 MB capacities.

The first motherboards that support RDRAM are expected to reach the market before the end of this year. Intel has a new chip set—code-named Camino—that supports RDRAM and other new high-performance features such as AGP 4X. The Camino chip set is also expected to support Pentium III CPUs with its 133-MHz bus speed.

A few dozen manufacturers are already providing RIMMs, including familiar memory-market names such as Hitachi, IBM Kingston, Micron, NEC, Samsung, Toshiba, and Viking. As a result, there should be ample supply once the motherboards reach the market.

FURTHER IN THE FUTURE

Looking ahead to future potential system performance bottlenecks, RDRAM is well-positioned to grow with anticipated advances in other components. For example, system bus speeds are expected to increase to 200 MHz in

the foreseeable future. Current SDRAM designs may have difficulty beyond 133 MHz, as the varying lengths and signal loads on the circuitry may cause problems for identifying data signals. The other way to increase SDRAM bandwidth would be to expand the width of the data channel itself—such as 128 bits instead of the current 64 bits—but this could result in unwieldy module designs and increased power demands.

RDRAM also has the potential for some massive capacities per module. 256 Mbit and 1-Gbit chips are planned, which would make 512-MB and 2-GB capacity RIMMs possible. It's easy to state that these should provide sufficient capacity for future microcomputer systems, but then again, it was not so long ago that users were having trouble figuring out what they'd do with 640K of system memory. So as the battle continues between software's demands on resources and hardware designs' ability to meet those demands, Direct Rambus DRAM may help tilt the scales in hardware's favor for a while longer. **PC**

Alfred Poor is a contributing editor of PC Magazine.

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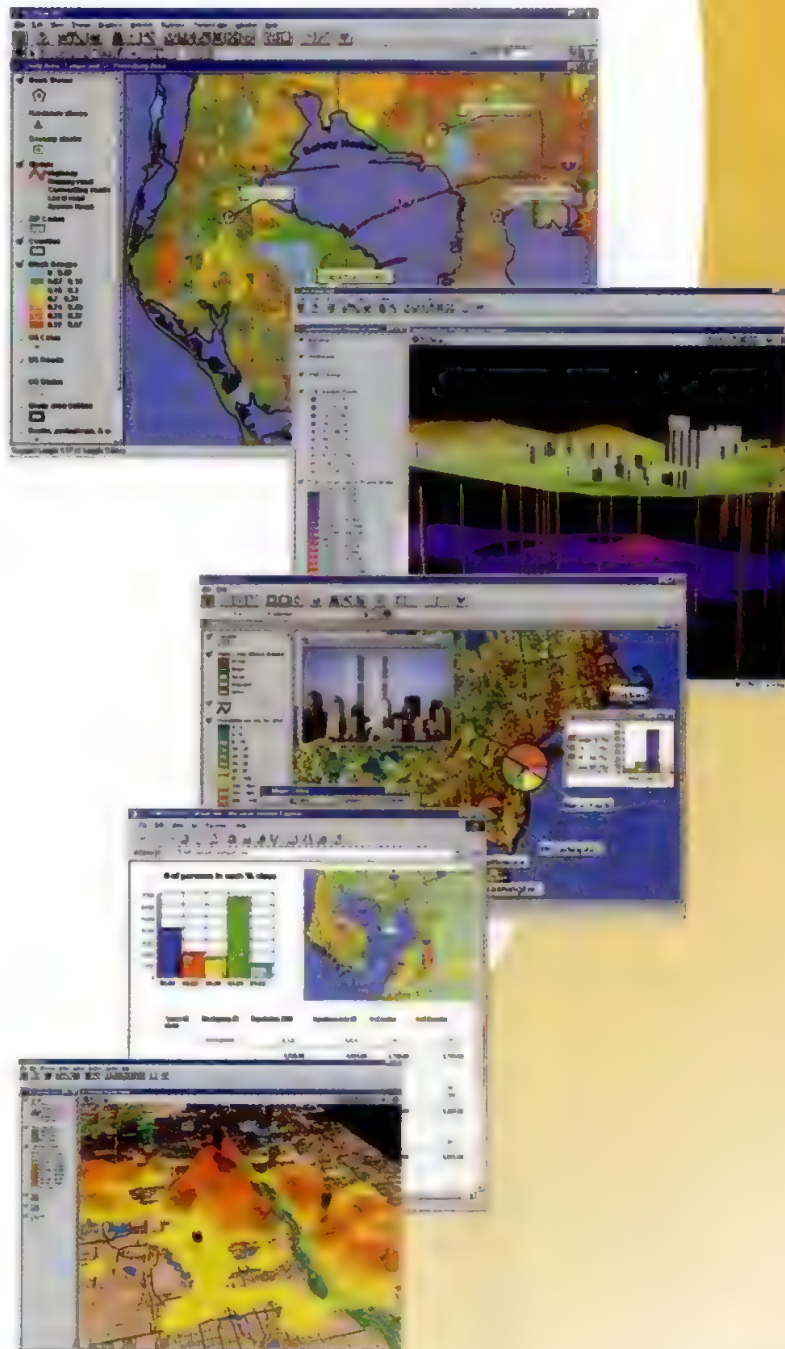
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A SECOND CHANCE



A SYSTEM CONFLICT...

A SECOND CHANCE



A USER ERROR...

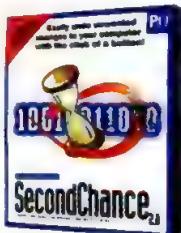
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Internet E-Mail Settings in Outlook

Get Outlook 98 or Outlook 2000's e-mailer to work the way you need it to. *By Neil Randall*

Microsoft Outlook 98 and Outlook 2000 offer several e-mail configuration settings devoted to Internet practices and standards. Here, we'll show you how you can configure these options to customize Outlook so that it functions effectively within the Internet's standards, and within your standards.

ACCOUNT CONFIGURATION

Let's begin with the *Accounts* dialog box, accessible through the Tools menu (*Tools | Accounts*). Click on any of your e-mail accounts and then on the *Properties* button. Two tabs in particular, *Servers* and *Advanced*, feature Internet settings. Usually, *My incoming mail server* will display as a POP3 server (see the crib sheet for a glossary of acronyms), but you can also establish each account as an IMAP account. The two are different protocols, and are entirely dependent on your ISP's e-mail server. Once an account has been created, you cannot reconfigure it from one protocol to the other.

The incoming and outgoing server fields reflect Internet standards. You won't want to change the incoming server (which will use either the POP3 or IMAP protocol), because that's the one that collects your mail. But for outgoing mail, you can use whatever SMTP server you want; as long as that server is set up to route mail from external addresses, it will send your mail.

An SMTP server can be configured to accept messages only from certain Internet addresses (either alpha or numeric), and can also be set to refuse relays. If you're logged on to one ISP and you attempt to send mail through the server of another ISP, that's a relay. But if you know of a server that doesn't restrict relays, you can use it. You can almost always use the SMTP server of the ISP you're currently logged into, even if your e-mail account is on another server entirely.

The other two configurable areas on the *Servers* tab are *Log on using Secure Password Authentication* and *My server requires authorization*. These fields, when checked, instruct Outlook to conform to Internet protocols for ensuring that your username and password are verifiably yours. You're likely to encounter these features on corporate servers rather than on typical ISP accounts, and you should check them only if your server administrator orders you to do so.

More Internet-specific configurations are available through Outlook's *Advanced* tab. Here you can set the port numbers for the mail servers. Data enters a server through its *ports*, or numerically defined channels. The default port for an SMTP server is 25. The port number is 110 for a POP3 server, and Web servers take

port 80. You can change these on the *Advanced* tab. The numbers are established by the server, though, so change these numbers only if you're instructed to by the server administrator. The administrator will also tell you if you're using an SSL connection for secure, encrypted transactions.

The rest of the *Advanced* tab lets you establish how you want the mail server to behave. You can tell the

server to time-out, or stop trying to receive or send, after a specified duration ranging from 30 seconds to 5 minutes. You can also tell the server that when Outlook downloads messages, you don't want them erased from the server (erasing is the default). This latter option is useful if you use the same e-mail account from multiple locations: By leaving messages on the server, you can download them later to a different computer. Your ISP will probably allow you to store only a certain number of megabytes of e-mail messages, so be sure to uncheck *Leave a copy of messages on server* on at least one of your machines.

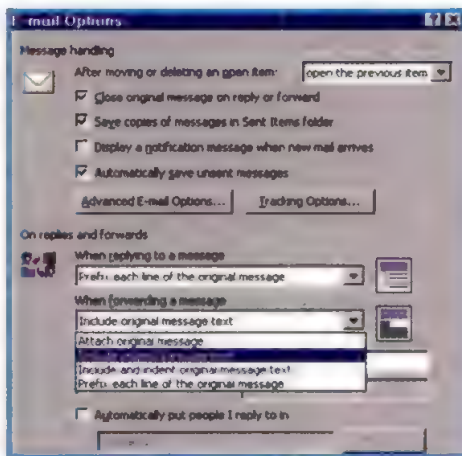


FIGURE 1: Outlook's E-mail Options dialog box lets you configure behaviors such as prefixes for messages you're replying to or forwarding.

Web Access Trouble

Occasionally, when I first log on, I can't seem to get into any Web sites. Is there anything I can do to avoid logging off and then back on (which usually solves the problem)?

*Laurie Middleborough
via the Internet*

There are several possible reasons for this problem, and the most obvious solution, as you suggest, is disconnecting from your ISP and trying again. This strategy is not practical with ISPs that have frequent busy signals, so try this rather strange trick: While logged on, open your browser and click in the *Address* (or *Location*) field. Instead of typing a URL based on a domain name—for example, www.microsoft.com—type the site's four-part numeric IP address (207.46.131.13 in Microsoft's case). Often, you'll get to the site, and then (or perhaps after trying one or two more IP addresses) you'll be able to use normal URLs. It's unclear why this works. It's almost as if you're priming your ISP's DNS server, the software that translates domain names into IP numbers, but sometimes it does work.

Other IP addresses: Netscape (207.200.75.200); PC Magazine (205.181.112.155); Yahoo! (204.71.200.243); and ZDNet (205.181.112.65).—NR

Prevent Cutoff of Alternate Text in IE5

If you have turned off *Show Pictures* in Internet Explorer 5's *Internet Options*, you should click the *Advanced* tab in the *Internet Options* dialog and place a check beside *Always expand ALT text for images*. When the actual pictures are not shown, you have to rely on the alternate (ALT) text. Checking this option ensures that the text is not cut off if the amount of text is larger than the image area.

*Bill Alward
via the Internet*

Turning off *Show Pictures* can make browsing over a slow connection less painful, but without the alternate text you may not know where to click. This tip costs nothing and ensures the alternate text will be visible. To see the difference, turn off *Show Pictures* and type a non-existent URL into IE5. The error message has a tiny rectangle

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next to the *Refresh* link, a box that would have contained a picture of the *Refresh* button:

Click the ☐ *Refresh* button.

Click the *Home* button, set the option described above, and again type a nonexistent URL. This time the rectangle will expand to show the alternate text:

Click the  *Home* button.

—Neil J. Rubenking

Unsending E-Mail

Sometimes I finish an e-mail message and then realize that I want to add or delete something, but I've already clicked the *Send* button and the letter is gone. Does Outlook Express provide a way to get around this?

M. Fernandez
via the Internet

Once you've hit *send*, the message is gone. But there are two ways you can avoid this predicament. In fact, all major e-mail packages provide two solutions. First, instead of sending the message after you type it, use the *Save* feature to store it so you can return to it. In Outlook Express (and Outlook 98 and 2000), the message is stored in the *Drafts* folder, and you can go into that folder and double-click the message to retrieve and edit it. Eudora Pro saves it as a text file, which is a bit more difficult to get at, but not much more difficult.

The second way—and we recommend this to all users—is to set the e-mail program to send messages only when you click the *Send/Receive* button (on OE and Outlook) or the corresponding button on other programs (*Check Mail* on Eudora, for instance). In OE or Outlook, select *Tools | Options*, click the *Mail Delivery* tab, and uncheck the box labeled *Send messages immediately when connected*. In Eudora, the feature is called *queuing* messages, and the *Options* area will let you turn the feature on. No matter what program you use, if you set your mailer to check for mail every x minutes, all your waiting messages will be sent at that time. But it does give you a bit of time to go back to a message and edit it. —NR

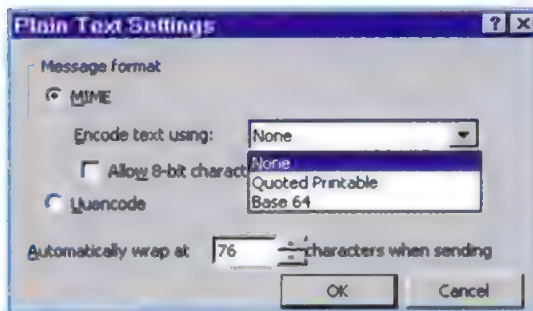


FIGURE 2: This dialog box is where you set encoding and word wrap for plain-text messages in Microsoft Outlook.

E-MAIL OPTIONS

Select *Tools | Options*, and click the *E-mail Options* button. This will bring up the dialog box shown in Figure 1. Most of the configurable behavior found here is Outlook-specific, but a few options let you make Outlook conform to Internet practices. In the middle of the *E-mail Options* dialog box, you'll see several options for replying to or forwarding a message. The usual behavior for text-based Internet mail programs such as Pine, Elm, and Mail is to prefix replies and forwards with a symbol such as the greater-than sign (>). You can do this with Outlook by selecting this option in the drop-down menu under *When replying to* or *When forwarding*, and you can specify the prefix character in the next field. Nothing bad will happen if you don't prefix messages, but many Internet users still work with text-based readers, and these prefixes help identify who wrote which part of the message. Choosing *Indent and include original message text* may cause confusion in some mail readers, so be careful when opting for it.

If you carry on a threaded correspondence with another user and both of you use the option *Prefix each line of the original message*, you'll find the lines wrapping incorrectly very quickly. This is somewhat less of a problem with Outlook Express, and in other mailers, such as Eudora and Calypso, the lines wrap properly for all consecutive responses. If you do a great deal of text-only Internet mail, you may prefer to use another mail program for multiple-reply correspondence. Microsoft seems oblivious to this problem, which has plagued users since Outlook 98's earliest days.

More Internet-specific configurations appear under the *Mail Format* tab of the *Options* dialog. In the *Message Format* area of the dialog, you can choose plain text, HTML, or Microsoft Outlook rich text as your default e-mail format. Only two of these, plain text and HTML, are Internet standards, and most of the e-mail you

send and receive will be in one of them. Be careful about using HTML format, however; not all e-mail programs can display HTML (the freeware version of Eudora, for instance, cannot display HTML and is still in widespread use). You can change the format of any message while composing it, using the *Format* menu of the composition window.

Also available from this box is a *Settings* dialog for each format. From the perspective of Internet standards, the *Plain Text Settings* dialog (Figure 2) is the most important. Here, you can choose to

encode your message using MIME, which is increasingly the standard, or using Uuencode, the older encoding standard. These standards allow mail to be sent in formats that can be read from other mail programs.

MIME is achieving popularity because of its ability to transmit graphics, sound, and video (Uuencode can't handle these). Under MIME, you'll see two additional encoding options, *Quoted Printable* and *Base 64*. These refer to established standards for encoding data for transmission over the Internet to be decoded into readable form at the receiving end. There's no need to select one, however, unless your recipi-

CRIB SHEET

Acronyms

1. **Elm:** Electronic mail.
2. **IMAP:** Internet Message Access Protocol (e-mail).
3. **MIME:** Multipurpose Internet Mail Extensions.
4. **Pine:** Pine is not Elm.
5. **POP3:** Post Office Protocol 3 (e-mail).
6. **SMTP:** Simple Mail Transfer Protocol (e-mail).
7. **SSL:** Secure Sockets Layer (Internet).
8. **Uuencode:** Unix to Unix Encode.

ent's e-mail program requires them. This dialog also lets you select the number of characters per line that Outlook will send, another accommodation for the behavior of Internet mail clients.

Outlook is a multipurpose program, but for many people it is, at its core, an e-mail package. To be an effective e-mail package, a program must work with existing Internet standards and behaviors, and Outlook does so quite well. Most of the configuration settings in Outlook are also available in Outlook Express, so if you use both, be sure to configure them similarly. PC

Neil Randall is a contributing editor of PC Magazine and author of *The Soul of the Internet* (ITP).

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Excel's Third Lookup Choice: Match

A more versatile lookup function can be an invaluable tool for getting the information you need.—By Craig Stinson

Excel's VLOOKUP and HLOOKUP functions are fine for plucking values out of orderly tables. VLOOKUP, the more commonly used of the two, scans the first column of a table and returns the appropriate value from one of the columns to the right. HLOOKUP works the same way, except that it scans the top row of a table and returns a value from one of the rows below.

But what if you need to pluck some particular value from a list or table that wasn't originally designed to be a lookup table? For that need, Excel supplies a third lookup function, called MATCH. More versatile than VLOOKUP and HLOOKUP, MATCH—in conjunction with other functions—can be an invaluable tool for getting the information you need out of your spreadsheet data. We'll look at several applications for MATCH here.

MINIMUM DAILY BALANCE

The first problem involves a cash-flow application. Deposits, checks, miscellaneous bank transactions, and daily balances are on a worksheet with one table row for each day of the year. Dates appear in A5:A369, balances are calculated in I5:I369, and various other data appears in the intervening columns. Cell I2 records the minimum daily balance value for the year, using the formula `=MIN(I5:I369)`. The problem is, how do you determine the date that corresponds to that minimum value. How can you find the row in which the minimum value appears, then get the value stored in column A of that row?

If the dates appeared to the right of the daily balances, we could use VLOOKUP. Since they don't, it's a job for MATCH. The formula

```
=MATCH(I2, I5:I369, 0)
```

returns the position within I5:I369 at which the value in I2 (the smallest daily balance) appears. For example, if the minimum is the fourteenth value in the column, the MATCH formula returns 14. With the help of the OFFSET function, we can use that result to move down the appropriate number of rows from A4 (the cell imme-

diately above the beginning of the date column) and grab the date at which the minimum occurred. The formula we need is

```
=OFFSET(A4, MATCH(I2, I5:I369, 0), 0)
```

which says, "From A4, move down MATCH(I2,I5:I369,0) rows and 0 columns, and return the value of that cell."

TESTING FOR A VALUE'S PRESENCE

If you need a formula that returns Yes if a cell is equal to any value in range, and No otherwise,

```
=IF(ISERROR(MATCH(A1, B1:B8, 0)), "No", "Yes")
```

does the job, assuming A1 is the cell with the value you're testing and the range is B1:B8.

The MATCH component returns the position at which A1's value occurs within B1:B8. If it

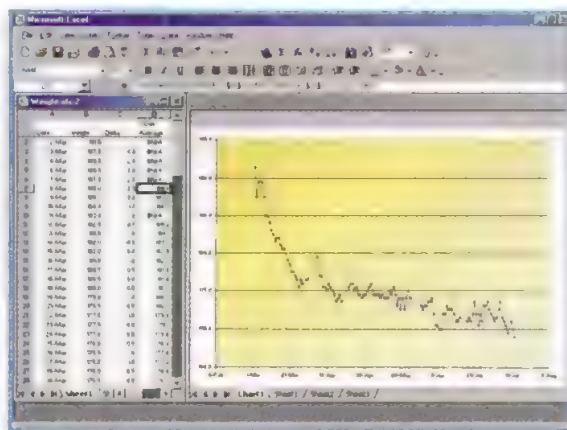


FIGURE 1: Excel's MATCH function enables you to generate charts like this weight log, even with missing datapoints.

occurs nowhere, MATCH returns #N/A, one of Excel's error constants. In that event, ISERROR returns True, causing IF to return No. If MATCH finds its match, ISERROR returns False, and IF returns Yes.

AVERAGING WITH MISSING DATAPPOINTS

A dieter maintains a daily weight log in Excel. While traveling on business he's unable to weigh himself, and on those days he makes no entry in the log. He's produced a chart with both the daily weight values and a seven-day moving average. The problem is that he wants each point on the trendline to report the average of the seven most

Jailed for Lack of License

I removed Microsoft Office 97 Professional Edition from my old computer and installed it on a new PC that came only with Office 97 Standard. But when I try to run Microsoft Access, I get a message saying there's no license. What can I do?

Michael Carl
Brandon, Florida

Somehow, Access did not properly register on your new computer. When a registry entry that Access needs at startup gets munged or deleted altogether, the result is an accusation of attempting to operate Microsoft Access without a license. Microsoft discusses the available workarounds in Microsoft Knowledge Base article Q141373. There is also a program you can download via article Q191224 that's supposed to help. To get these articles, point your Web browser to <http://support.microsoft.com/support/search/c.asp> and search for them by article number.—Sal Ricciardi

Ever-Growing Access Files

I'm working on converting some dBASE files to Microsoft Access. I also periodically import dBASE files to Access tables, replacing old records. The Access file size increases as expected when I add the new records, but does not decrease when I remove the old records. As a result, the file keeps getting bigger and bigger. This happens even when I delete all of the old records before importing the new ones. Is there some kind of internal recycle bin in Access that prevents the records from being deleted completely? How can I reduce the file size?

Simon C. Chang
Los Angeles

You need to regularly compact the Access database. That's how you release the space allocated to deleted records. To compact a database, select the Tools menu, select Database Utilities, and then choose Compact Database (in Access 97) or Compact and Repair Database (in Access 2000). If you're using Access 2000, you can do this automatically whenever you close a database. Select the Tools menu, then select Options, then click the General tab and choose Compact on Close (make sure it's checked).—SR

TO USER

USER

Replace an Error with a Blank Cell in Excel

I have some spreadsheets for rate calculations that occasionally return DIV/0 errors. I'd rather have the results show as 0's or even blank cells. Is there any way to do that in Microsoft Excel?

David Nieves
via the Internet

One way to solve the problem is with an IF function that tests whether the formula you want to use produces an error, and substitutes a 0 or a blank entry if it does.

Suppose, for example, that you want cell A1 to show the result of B1 divided by C1. You could enter the formula in A1 as

```
=IF(ISERROR(B1/C1),"",B1/C1)
```

This tells Excel to check if B1/C1 yields an error: If it does, Excel will leave the cell blank. If it doesn't, Excel will enter the result of B1/C1. If you want Excel to enter a 0 instead of leaving the cell blank, substitute a 0 (zero) for the quotation marks. —M. David Stone

recent days, not the seven most recent data points. (If all he wanted was an average of the seven most recent points, Excel's *Add Trendline* command could meet his needs automatically.)

The cleanest solution would be to set up the worksheet from the start to include all the possible dates, leaving empty cells in the weight column for days on which no weight was recorded. Given that our dieter did not set things up this way, he can solve his problem by adding a special moving-average column to the weight table, using MATCH to fetch data only from the seven most recent days. Figure 1 shows the table and associated graph.

We have dates in column A, weights in column B, and the moving average in column D. The model for the moving-average formulas may be seen at D7:

```
=AVERAGE(OFFSET($A$1,MATCH(A7-6,$A$2:A7,0),1):B7)
```

Here, MATCH is used to find the position at which the date six days prior to the current date occurs. OFFSET uses this position as a row offset from A1. The 1 supplied at the end of the OFFSET function moves us one column to the right, so we're averaging weights, not dates. And the

AVERAGE function takes the average from the weight corresponding to six days back to today's weight. Where there is no record corresponding to a date six days before today, the moving average formula returns #N/A (see cell D10 in the figure).

THE THIRD ARGUMENT

In each of these examples, we've used 0 as MATCH's third argument. The third argument, which is optional, may be -1, 0, or 1. If it's -1, MATCH looks for the first value greater than or equal to the lookup value (the lookup value is the function's first argument). If it's 0, MATCH looks for an exact match and returns #N/A if it doesn't find it. If it's 1, MATCH looks for the largest value less than or equal to the lookup value. The default is 1.

If you're using 1 or -1 as the third argument, the range you're investigating (the second argument) must be sorted. When the third argument is 1, the range must be in ascending order. When the argument is -1, the range must be in descending order. If you use 0 and look for exact matches, you don't have to sort. **PC**

Craig Stinson is a contributing editor of PC Magazine.

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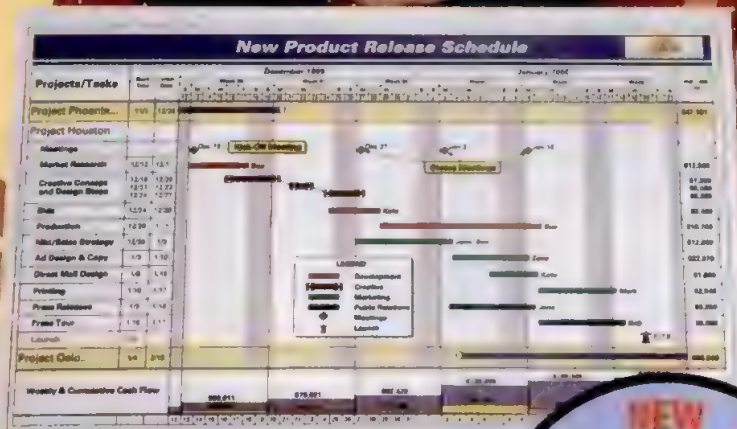
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Manage Your System Resources

Resources aren't the scarce commodity they used to be, but you'll still want to keep an eye on them. *By Neil J. Rubenking*

Sometimes, when you try to launch a program, Windows 9x will display the alarming error message shown in Figure 1. This message is almost invariably misleading. Your system hasn't run out of memory; it has run out of *system resources*. In this context, the term system resources refers to five specific areas of memory called *heaps*, which hold low-level programmed objects required by Windows itself. These heaps belong to the core Windows libraries USER32.dll and

particularly programs that are launched at startup and run in the background. If the computer in question runs for long periods with a single application loaded, that application is also suspect. When a program repeatedly allocates system resources and doesn't free them, free system resources decrease steadily while the program is running, causing a *resource leak*. If the leak is small, restarting the system every day may prevent it from having a significant effect. If the leak is bigger, or if the system can't be restarted every day, you'll have to locate the source of the problem.

Windows 9x comes with a simple resource meter that tracks the percentages of free USER and GDI resources, and pops up a

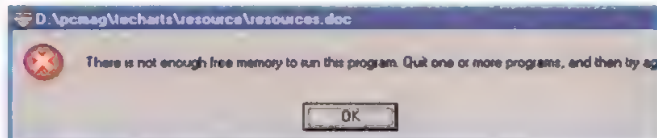


FIGURE 1: When Windows 9x says you're out of memory, it usually means you're out of system resources.

GDI32.dll. The three USER heaps store internal information about active programs and their menus, among other things. The two GDI heaps store system objects related to graphics—fonts, brushes, pens, and so on.

Three of the heaps use modern, 32-bit addressing, with a capacity vastly greater than the system ever requires. Both USER and GDI, however, each have one heap that uses 16-bit addressing, with a 64K capacity. These 16-bit heaps, left over from Windows 3.x, cause all resource bottlenecks. Every Windows program requires resources from one or both of these heaps. If the entire heap is in use, no more programs can be launched, and Windows 9x can't function properly.

Windows 3.x had only three system resource heaps, all of them 16-bit, so system resource problems were much more common. Worse yet, it relied on individual programs to free up the resources they allocated. If a poorly written program failed to do so or crashed, the amount of available system resources would be reduced for the duration of the Windows session. Windows 9x is much smarter: It keeps track of which program allocated each object in the system resource heaps. When a 32-bit program terminates, Windows 9x automatically frees any remaining system resources allocated to that program. System resources allocated to a 16-bit program are freed when every 16-bit program has terminated.

Under Windows 9x, resource problems are caused by programs that do not terminate, par-

ticularly programs that are launched at startup and run in the background. If the computer in question runs for long periods with a single application loaded, that application is also suspect. When a program repeatedly allocates system resources and doesn't free them, free system resources decrease steadily while the program is running, causing a *resource leak*. If the leak is small, restarting the system every day may prevent it from having a significant effect. If the leak is bigger, or if the system can't be restarted every day, you'll have to locate the source of the problem.

Windows 9x comes with a simple resource meter that tracks the percentages of free USER and GDI resources, and pops up a

warning if either gets down to 10 percent. Launch the meter from *Start | Programs | Accessories | System Tools | Resource Meter* and then double-click its *system tray* icon to see the display (Figure 2). Longtime Windows users may notice that the free resources percentages at startup seem higher under Windows 9x than they were under Windows 3.x. That's no illusion—the percentages are calculated differently. Under Windows 3.x, the free percentage for a heap was calculated by dividing the number of free bytes into the total size of the heap. Windows 9x calculates this percentage by dividing the number of bytes free now into the number of bytes that were free just after Windows finished loading. This makes sense, as the resources allocated by Windows at startup can't be freed for use by other processes.

To check for a resource leak, start by establishing a baseline set of programs that are normally running on your system. Make a note of the USER and GDI percentages reported by Resource Meter. Now record the percentages again at regular intervals, perhaps every half hour. Before noting the percentages, close or open programs as necessary to restore the baseline program set, and wait a few seconds to give Resource Meter a chance to update its report. If the free system resources show a steady decline, your system has a resource leak.

You'll find the source of the leak by a process of elimination. Use the *PC Magazine* utility Startup Cop to examine which pro-

Fix Tiny Tray Icons

I mistakenly installed an update for my ATI display driver. I then managed to reinstall the original driver, but the system tray icons are now so tiny I have to point to them and look at the ToolTip to see which is which. Also, the *minimize*, *restore*, and *close* icons at the top of each window are squeezed together so I can't read them. The *Display Properties* dialog doesn't list these items. How can I fix this?

Forrest Cummings
North Miami Beach, Florida

Many of the *Display Properties* settings have broader effects than their names suggest. For example, the height of the Active Title Bar affects the size of system tray icons. Normally, Windows won't accept out-of-range values for *Display Properties*, but a defective display driver could indeed subvert this protection. To recover, do this: Right-click the desktop and choose *Properties* from the pop-up menu. Click the *Appearance* tab. In the *Scheme* list, select *Windows Standard* and click *Apply*. This should restore the default settings. —NJR

Snap to It

In the X Window environment, the mouse pointer automatically snaps to the center of the default button of any dialog box. When an alert or dialog box appears, you don't have to move the mouse to it yourself. Custom mouse applets sometimes support this functionality in Windows. In Windows NT 4.0, however, you can enable it yourself with a simple Registry edit. In the key HKEY_CURRENT_USER\Control\Panel\Mouse, find or create the string value *SnapToDefaultButton* and set its data to 1. This feature can be very useful on large monitors with high resolutions, on very busy screens, or with finicky pointing devices.

Jason Fisher
Dallas, Texas

First, check to see whether the *Control Panel Mouse Properties* applet on your system supports this feature. If so, use it! When you change the *SnapToDefaultButton* setting using Regedit, the change doesn't take effect until you restart Windows NT, or at least log off and log on again. Unfortunately, this setting will have no effect under Windows 9x. —NJR

Send Files to Any Program

Here's a handy way to open a data file with a program other than the one associated with the file's type. Choose *Run* from the *Start* menu and enter the command *sendto*. This will open the *sendto* folder, containing the links that appear in the *Send To* menu. Choose *File | New | Shortcut* and create a shortcut to the desired program in this folder. Or right-drag an existing shortcut from the *Start* menu and choose *Copy here*.

To open a file with this program, right-click the file, choose *Send To*, and then choose the program you want to use. You can use this method, for example, to open HTML files in a text editor rather than your browser.

Lawrence Goetz
Brooklyn, New York

Virtually any program that accepts a data file name on its command line can be added to the *Send To* menu in Windows 9x or Windows NT. If launching *sendto* in the *Run* dialog doesn't open the folder, use the *Find* command to search for the *sendto* folder in or below your Windows folder. —NJR

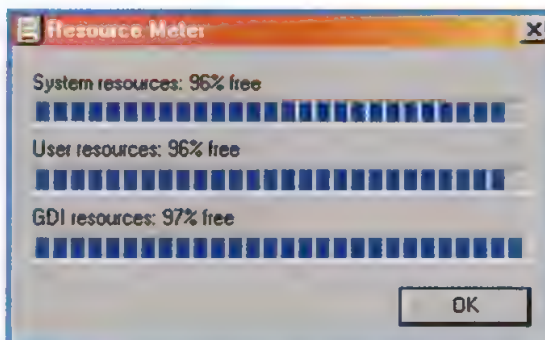


FIGURE 2: The Windows Resource Meter tracks available system resources and warns you if they drop below 10 percent.

grams are launched at startup, and disable half of them. Restart the computer and repeat the earlier exercise with Resource Meter to determine if the resource leak is present. If resources still decline steadily, then the programs you disabled are innocent. Use Startup Cop to re-enable them, disable the other half of the startup programs, and restart the computer. Check again for resource leakage. If it has stopped, you know that one of the disabled programs is the resource hog. Repeat this

process, disabling half of the remaining suspects at a time, until you pinpoint the culprit.

If none of the startup programs are responsible for the leak, then perhaps the problem is in an application that runs for many hours at a time. For each such application, you'll have to stop using it long enough to determine whether the resource leakage stops. Once you identify the program that's causing trouble, contact the manufacturer for an update. If you're lucky, you'll find that other people have encountered the problem and a fix already exists.

Like your appendix, the 16-bit resource heaps are vestiges of an earlier stage of evolution. And like the appendix, they can cause problems out of proportion to their size. Windows NT and Windows 2000 don't suffer from this limitation, but if your system is running Windows 9x, you'll have to beware of running out of system resources. **PC**

Neil J. Rubenking is a contributing editor of PC Magazine.

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Network Wiring Alternatives

There are a number of ways to network your small office, even when installing new cable is not an option.—By Steve Rigney

With the introduction of Plug and Play adapters, auto-sensing hubs, and built-in client software, installing a small office network has become relatively easy. Unfortunately, network vendors can't work the same magic on your office's building design, so network cable is one component that can still be very expensive and difficult to install. Structured wiring systems installed by cabling professionals usually cost several hundred dollars per drop. Many organizations find these costs prohibitive and stretch cables under dividers, over ceiling tiles, and around doorframes. While we always recommend using standard Ethernet cabling and products, we realize that sometimes administrators just don't have a choice. The barriers to using a professionally installed, structured cable system can range from budgetary constraints to physically inaccessible buildings. Until everyone is lucky enough to move into an office with drop ceilings and raised floors, network cabling is always going to be an issue, so let's look at some alternatives that might make your life easier.

PHONE-LINE NETWORKING

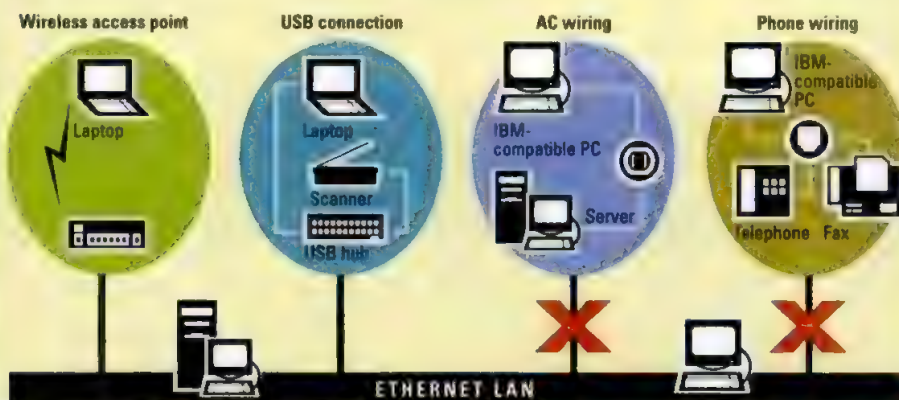
While your small office may not be designed for easy cable installation, it's a safe bet that you have telephone lines going to each desktop. Several vendors have taken advantage of the ubiquitous telephone lines by creating a net-

work connectivity solution that can use existing office wiring. The Home Phoneline Networking Alliance (HomePNA) was founded in June 1998 by 11 companies: 3Com, AMD, AT&T Wireless, Compaq, Conexant, Epigram, Hewlett-Packard, IBM, Intel, Lucent Technologies, and Tut Systems. Since then, more than 70 vendors have signed on to work on the technology and offer competing products. In a nutshell, the alliance has created a standard for home networking that takes advantage of existing telephone-line wiring. HomePNA networks use higher frequencies (5 MHz to 10 MHz) than phone and modem lines (less than 4 KHz), so users can network over the phone lines at the same time they're talking to someone, faxing, or surfing the Web.

Most HomePNA kits, such as Diamond Multimedia's HomeFree Phoneline, cost about \$100 and include everything you need to network two PCs. The kits consist of two PCI adapters and software drivers for Windows. If you don't want to install an adapter in your PC, you may want to consider the Intel AnyPoint Home Network solution. Unlike most HomePNA solutions, AnyPoint adapters connect to the parallel port on your PC, so there is no need to open the case. Although connecting a box to the back of your PC is a lot easier than installing an adapter, there are some drawbacks. Most parallel ports, for example, can handle data only at speeds of around 300 Kbps. This is

Wiring Alternatives

There are a lot of alternatives for wiring a small office network, ranging from using the AC wiring in the building to shooting radio waves through the air. Be careful which one you choose, though, because they don't all interoperate, and some may limit your network's growth potential, as shown here.



Easy Printer Sharing

I want to connect two computers in my office so they can share a printer. I can understand why I need LAN cards, but why do I need to buy a hub? Can't I just connect the two LAN cards with a cable?

Marty Newhouse
Cheyenne, Wyoming

You don't have to buy a hub. You can use a cable, but it has to be a special one. Typical LAN cables are *straight through*: Pin 1 on one end connects to pin 1 on the other end and the hub takes care of managing the transmit and receive signals. To connect two PCs without a hub, you'll need what's known as a *crossover* cable, meaning that different pins are connected so that both sides transmit and receive on different wires. If you search for crossover on a Web site like CDW's (www.cdw.com), you'll find the Linksys UTP 10 for \$9.80; that's what you need. But keep in mind that you won't be able to use that cable if you add a hub at a later date.—Frank J. Derfler, Jr.

Do-it-Yourself Cabling

We have a small business with about ten computers and we're moving to a new office. The new space consists of one open room with cubicles. We administer our own NetWare servers and have a 3Com router for the Internet. Can we install our own cabling for 100Base-T Ethernet, or do we need a professional installer?

Harry Ames
Charlotte, North Carolina

When you want to be sure, always go with a pro. But, of course, a professional installation is quite expensive. If you're not piercing any permanent walls or ceilings, I think you can safely install a network hub or switch and route the cabling yourself using pre-packaged and certified cables. Don't try pressing on RJ-45 connectors yourself—it's a learned skill. If you surf to DataComm Warehouse (www.warehouse.com) you'll find Beldin-manufactured Category 5e (enhanced) certified cables in 50-foot lengths with connectors for \$27.99. That's a bargain.—FJD

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The Best Policy

Even small companies need a written Internet-use policy document. All companies are subject to the same laws concerning fraud, libel, and sexual harassment. E-mail can be subpoenaed, and it can be traced to its original sender. Most messages, files, and data stored on PCs can often be recovered even after users think they have been deleted. Because companies can be held liable for employees' actions using company-owned PCs, the best practice is to have a clear statement of acceptable Internet use. Your company Internet-use document, which should be in writing and discussed with or explained to all existing and new employees, should establish policies on company and personal e-mail, offensive or obscene content, and use of company PCs to access the Internet for personal or business use not related to your company. If you don't want employees to check auction sites, send jokes to friends, engage in electronic stock trading, cruise the Web for sites of personal interest, or even run a side business during lunch hour or after work, your Internet-use document should state your policies explicitly.

—Bruce Brown

Making the Switch

We've run out of ports on our old, reliable, 24-port LAN hub and we need to expand. I see that the prices of switches have dropped way down. Can we add a switch to the network? And how will it work with the existing hub?

Greg Newell
Bennington, Vermont

The price of switches is now at about \$30 per port for a non-managed 10/100 device. At that price, it's difficult to see why anyone would ever buy a hub again. Certainly you can add a switch next to the hub, but be smart and use the switch to create some separate contention domains. Give any servers and any other busy nodes dedicated switch ports. Fill up the switch and leave hub ports vacant. Then find the uplink switch on the hub and connect the hub's uplink port to a switch port. You may also want to consider buying enough switching capacity for the whole LAN.—FJD

much slower than a traditional Ethernet 10- or 100-Mbps link, and as DSL and cable modems become more prevalent, AnyPoint parallel connections could end up being slower than your link to the Internet. Fortunately, Intel also offers a PCI version of AnyPoint.

Right now, HomePNA-based products are limited to just 1 Mbps as opposed to Ethernet's 10 Mbps or 100 Mbps. Still, unless there's a need to run a lot of streaming video or bandwidth-intensive applications, these products should be suitable for many of the applications and data users need to share. The vendors are working to increase the throughput of the HomePNA products. Companies like Epigram are already working on 10-Mbps phone-line technology, which is being adopted by several vendors, including 3Com and Cisco. Both plan to have 10-Mbps products by the end of 1999. This new high-speed specification, however, may cause some problems with interference. FCC requirements stipulate that products must not leak any RF in the form of interference. As throughput increases, the chances of RF interference become higher. The possibility exists for mutual interference with radio scanners, amateur radio systems, and even police and fire equipment.

There are some specific problems and limitations you should note with HomePNA phone line technology. If you have two phone lines in the office, all networked systems must be on the same line. Also, although users should be able to combine standard-based HomePNA cards from different manufacturers on the same network, there might be some interoperability issues that you wouldn't run into with Ethernet adapters. Most importantly, you can't mix and match most HomePNA products with traditional Ethernet solutions. For example, if you have a network adapter installed in your PC or networking implemented on your laptop and you try to install AnyPoint, the driver software will not install.

POWER-LINE NETWORKING

Besides phone wiring, the other ubiquitous cable in most businesses is AC power cabling. A handful of vendors now offer products that use existing AC wiring to send data at speeds of 350 Kbps. One such product is the Intelogis Pass-Port Plug-In Network, which uses an external box that connects to a PC's parallel port. Although this may be a reasonable solution for light data transfers and surfing the Web, 350 Kbps is considered too slow for heavy graphics and other bandwidth-intensive applications. On the horizon is another alternative, however: Technology developed by Enikia Inc. promises to increase power-line data-transfer speed to 10 Mbps, with better protection against interfer-

ence. Enikia-based products should be able to handle up to 256 nodes on a single LAN segment. Even better, products that use Enikia's technology will be able to connect to standard Ethernet adapters, allowing users to rely on standard solutions such as PC Cards and drivers that will work with any PC on the market. Unfortunately, high-speed and reliable power-line devices are still a year or two away.

Power-line networking faces other challenges as well. There are many problems involving transmission blocks and interference from high-current devices such as motors and RF devices such as microwave ovens. High-speed networking over AC power lines will have to prove itself to many skeptics.

USB NETWORKING

USB is not only great for daisy-chaining scanners, printers, and modems to a single port on a PC, but the bus technology's high speed also makes it useful for connecting two or more PCs together for file and printer sharing. USB specifies data-transfer rates of up to 12 Mbps, but the length of the cable at this speed is usually limited to around 12 feet. One of the more common uses of USB for networking is to connect to an



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Because many of the concerns involved in networking small offices are similar to those encountered when networking a home, you should take a look at the feature "Network Your Home" in our April 6 issue (www.zdnet.com/pcmag/stories/reviews/0,6755,2226069,00.html). And to learn more about what's happening in the world of small-office networking, visit the following sites. You'll find all of these links on the Hot Links page at the above address on our Web site.

► European Telecommunications Standards Institute

www.etsi.org

This organization developed the HIPERLAN standard for high-performance radio networks.

► Home Phoneline Networking Alliance

www.homepna.org

This association of vendors is working to develop a single standard for phone-line networking in homes and small offices.

► Home Radio Frequency Working Group

www.homerf.org

The group's goal is to establish SWAP as the basis for voice and data sharing on wireless radio-frequency networks.



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Appoint a Backup Czar

When you lose important company files, the cost in time and effort to recapture or recreate the missing information, as well as the potentially significant disruption of company business, can range from irritating to disastrous. Since most people's attitudes about making backups range from casual to nonexistent, the best data loss-prevention measure is to appoint one person responsible for company PC backups. The company backup czar should work from a written backup procedure and have reasonable access to all company PCs in order to do the job efficiently. Be sure to appoint a stand-in so your company doesn't suddenly become vulnerable when the primary backup person gets sick, goes on vacation, or leaves the company. —BB

Calls over the Internet

I'm interested in saving money by making telephone calls over the Internet. How do I get started?

James Brody
New York, New York

There are two types of IP telephone calls: Those that stay on the Internet all the way and those that hop off the Internet into a regular commercial telephone system. The Internet-only calls cost less to make, but require a computer setup at both ends. In either case, the first step is to get a good sound card and a headset.

The standard PC sound card typically provides half-duplex (talk or listen) operation. A specialty card like Quicknet's Internet PhoneJACK (www.quicknet.net) provides full-duplex with the best quality available. Some cards come with IP telephony software.

You can use Internet telephone systems to make PC-to-PC calls using a service such as ICQ (www.icq.com), or you can make calls to regular telephones through what are called hop-off services such as IDT Corp.'s Net2Phone. You can download Net2Phone software free from www.net2phone.com. IDT (www.idt.net) has gateways connecting the Internet to local phone systems in many countries. As an alternative, also check out www.inter-fone.com, which offers telephone-to-telephone communication over the Internet. —FJD

Ethernet LAN. ADS and 3Com offer USB-to-Ethernet converters that enable you to make an Ethernet connection to a USB-equipped PC without adding an internal Ethernet card. These products have many uses, including aiding mobile salespeople who need to set up impromptu networks on the road and also connect to the corporate network while in the office.

For the small office, products such as Entegra's \$80 (list) USBnet offer the best price point and the easiest installation. The USBnet is a seven-port USB hub that also incorporates an Ethernet port. While USB networking makes a lot of sense for a single office in the home, the distance limitations make wiring an entire office almost impossible. But using a product like USBnet can be very handy for quickly adding PCs to the network without pulling more cable.

WIRELESS NETWORKING

Users can avoid phone-line- and wiring-related shortcomings with a radio-based wireless network, but some new obstacles arise. Most wireless networks use either the 900-MHz band or the 2.4-GHz band. For either class, the maximum distance allowed between systems is usually 150 feet, but users also have to consider the effects of metal structures, walls, and other impediments to radio

waves. Thus, the location and positioning of the PCs are an issue. In an effort to offer a wireless small-office solution, several vendors, including 3Com, Apple, Diamond, and IBM, formed the Home Radio Frequency Working Group in March of 1998.

The HomeRF Working Group has passed a standard for radio-based networks called the Shared Wireless Access Protocol (SWAP), which allows data-transfer speeds of 1.5 Mbps to 2 Mbps. The SWAP specification defines a new common interface that supports both data and voice services. Products compliant with SWAP operate in the 2.4-GHz frequency band and use frequency-hopping, spread-spectrum radio frequency technology. HomeRF products meeting these specifications aren't expected before the end of 1999, however. In the meantime, several companies already offer wireless network solutions, with different configuration options for getting connected.

Diamond Multimedia's HomeFree Wireless Network product runs at 1.5 Mbps and offers ISA cards for older computers, PCI cards for

newer machines, and PC Cards for notebooks. WebGear's Aviator connects to either a parallel port or a USB connector. InnoMedia's InfoAccess connects to a serial port. In each case, hardware installation consists of plugging a card into the computer or plugging a cable into the appropriate port. Prices for these wireless adapters range from about \$80 to \$150 per PC.

The drawback to wireless networks today is the lack of speed. Claimed throughput is typically 0.5 Mbps to 1.6 Mbps, depending on the package. Actual performance is usually slower, and transferring the same data on a wireless network usually takes longer than on a wire-based network with the same claimed data-transfer speed.

Fortunately, there is a new wireless standard designed to increase the throughput. The HIPERLAN (High Performance Radio LAN) Type 1 wireless LAN standard was ratified by the European Telecommunications Standards

Institute in 1996. HIPERLAN is designed to provide wireless performance equivalent to that of wired LANs such as Ethernet. HIPERLAN operates in the 5-GHz frequency band using Gaussian Minimum Shift Keying modulation, and coexists with current 2.4-GHz wireless products. So far, Proxim's RangeLAN5 wireless adapters and access points

are the only announced HIPERLAN products.

Using a product like
USBnet can be very
handy for quickly adding
PCs to the network without
pulling more cable.

THE BEST SOLUTION

There are a few more wiring alternatives that we didn't cover in this review, such as Infrared and a new wireless technology under development called Bluetooth. Both of these technologies, however, are limited to short distances and aren't designed for networking a small office. Because we stand behind the use of Ethernet standards to insure interoperability, support, and performance, wireless is our favorite alternative. All of the popular wireless solutions are based on the Ethernet 802.11 standard. This insures compatibility, ease of use, and future upgrades and product options. Non-standard solutions do not provide the multi-vendor support that serious administrators can rely on. When you can't pull cable, wireless Ethernet solutions are your best alternative. We also realize that cost is an issue, and as long as you don't try to mix and match different products, you may find a proprietary solution will work fine for you. ☐

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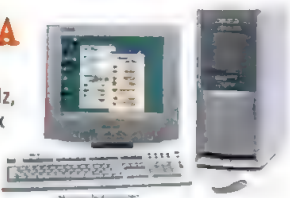
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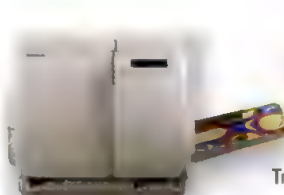
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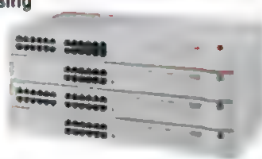
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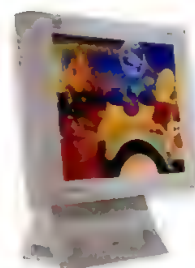
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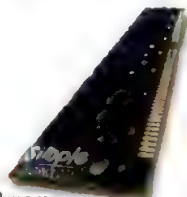
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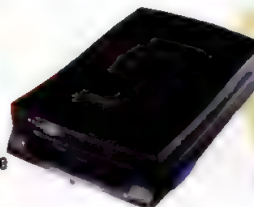


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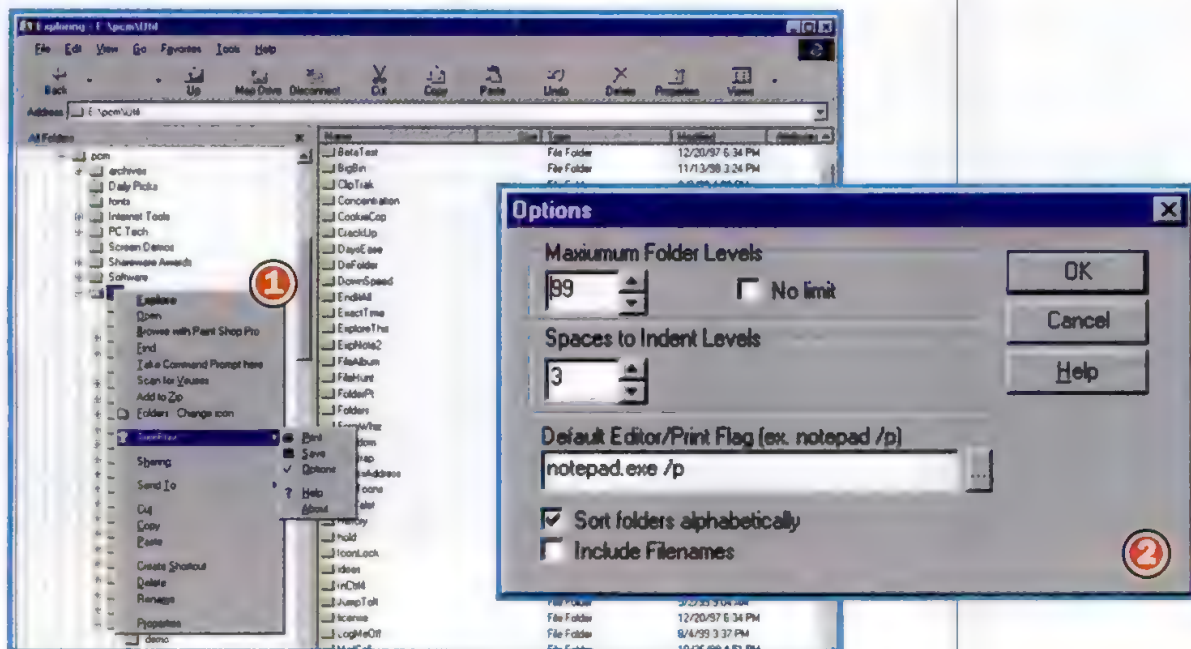
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Print Directory Trees from Explorer

When you need a printout of a directory structure, TreePrint can get the job done.—by *Steven E. Sipe*



Remember the old DOS program TREE.COM? It displayed the directory and file structure, and you could pipe the output to a file or printer. TREE.COM was never updated to support long filenames, and it disappeared with Microsoft Windows 95.

This issue's utility, **TreePrint**, is a replacement for TREE.COM that you can access from within Windows Explorer. Right-click on a folder and use the TreePrint menu to print the directory tree or save it to a file, starting at the point where the mouse cursor is when you click.

There are also options that let you control the number of levels shown, the amount of indentation for each level, whether to include filenames, and whether the tree is sorted alphabetically. TreePrint is especially useful for documenting the contents of archive media such as CD-R disks.

TreePrint runs under Windows 95, Windows 98, and Windows NT 4. An article about how to use TreePrint and how it was written is available on our Web site at www.pcmag.com/utilities. A link to download the utility and its Visual C++ source code can also be found there.

1. To access the TreePrint menu, right-click on a folder in Windows Explorer. You can then print the directory tree or save it to a file, starting at that point.

2. Select **TreePrint\Options** to bring up the **Options** dialog. From here you can control the number of levels shown, the amount of indentation for each level, whether to include filenames, and whether the tree is sorted alphabetically. If you don't include filenames, TreePrint will list only subdirectories.

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Steven E. Sipe, the author of TreePrint, is a developer based in Wilmington, North Carolina. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

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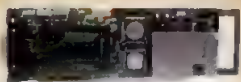
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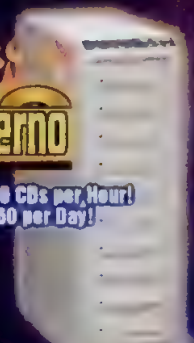


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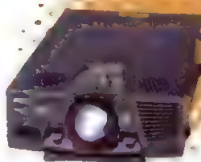
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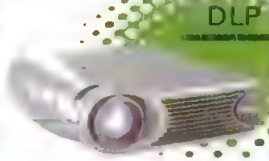
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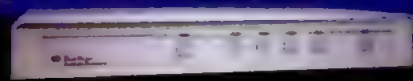


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Intel Pentium III 1200	200	Intel Pentium III 1300	210
Intel Pentium III 1400	220	Intel Pentium III 1500	230
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Intel Pentium III 2600	340	Intel Pentium III 2700	350
Intel Pentium III 2800	360	Intel Pentium III 2900	370
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Intel Pentium III 3200	400	Intel Pentium III 3300	410
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Intel Pentium III 4800	560	Intel Pentium III 4900	570
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Intel Pentium III 5200	600	Intel Pentium III 5300	610
Intel Pentium III 5400	620	Intel Pentium III 5500	630
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Intel Pentium III 5800	660	Intel Pentium III 5900	670
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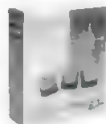
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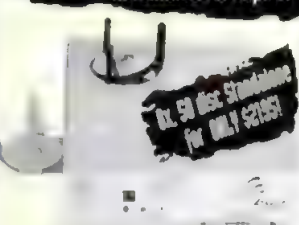


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AFTER HOURS

THE HOME SIDE OF COMPUTING



3-D BASEBALL GAMES

Play-Off Fever

By S. Jae Yang

Tremendously improved graphics and animation make today's 3-D baseball simulation games so much more immersive and lifelike than their predecessors, they make it seem almost as though you're really at the ball park. Next thing you know, you'll develop a craving for chewing tobacco.

Four games are included in this year's roundup: Interplay Sports' *Baseball Edition 2000*, Accolade's *HardBall 6 2000* Edi-

tion (Accolade is now a part of Infogrames North America after a merger with Infogrames), 3DO's *High Heat Baseball 2000*, and Microsoft *Baseball 2000*. A fifth title, EA Sports' *Triple Play 2000*, earned a three-star rating during our 3-D gaming roundup in August (After Hours).

Each title integrates the complete 1999 Major League Baseball player roster. What you can do with that roster—such as trading players and downloading updates from the Internet—varies from game to game.

All but one of the simulations require a game pad for full game-play enjoyment. The one exception is *Triple Play 2000*, which plays just fine with a joystick.

Because all the games are 3-D by definition, they all require at least a Direct3D-compatible card. *High Heat Baseball 2000* calls for 3-D accelerator hardware. Interplay, *HardBall*, Microsoft, and *Triple Play* are all capable of 3-D software emulation, but we highly recommend a 3-D accelerator to avoid choppy animation. 3-D graphics for all titles

are achieved through Microsoft's DirectX API.

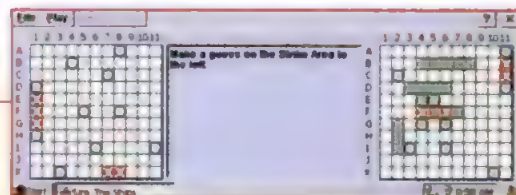
High Heat Baseball 2000 wins our Editors' Choice for delicately balancing top-flight animation and strategic baseball elements. But that doesn't mean it's the best baseball simulation for everyone: Baseball purists may have more fun with *HardBall 6 2000* Edition in spite of its mediocre graphics, because it excels at reproducing the subtleties of playing, managing, and owning a ball club.

These games require a degree of knowledge about baseball and its statistics (not to mention hand/eye coordination) that's probably out of the reach of most younger kids. Children under 10 should be steered toward *Humongous/GT's* fun, entertaining, and more age-appropriate *Backyard Baseball* (\$19.99 list; www.humongous.com).

Baseball Edition 2000

Interplay Sports' *Baseball Edition 2000* has graphics quality equal to or better than any other baseball simulation game currently on the market. The stadiums look authentic, and the players are rendered with meticulous attention to detail. You can even see the impressions of the sliding pads worn beneath their uniforms.

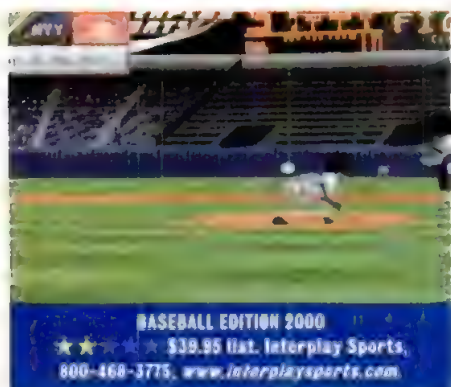
Though the players and ballparks are shown in great detail, animation and game play are not always fluid. At times, the graphics seem choppy. It's as though the animators



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Check out the latest games for Windows CE hand-held PCs, palm-size PCs, and 3Com PalmPilots. Page 220.

AFTER HOURS



grounder or catching a fly ball, the animators mix it up a bit. Infielders are sometimes forced to make bare-handed plays, and outfielders can make

major leagues, you can download updated player rosters and statistics from Interplay's Web site.

Though *Baseball Edition 2000* is appealing graphically, its lack of smooth transitions and some of the more advanced features found in competitors like *High Heat Baseball 2000* and *Triple Play 2000* diminishes its overall appeal. —*Dan Evans*

HardBall 6 2000 Edition

A boon for the purist, *HardBall 6 2000 Edition* maintains a venerable tradition of strategically and statistically faithful virtual baseball.

Like most other 3-D baseball games, *HardBall 6* lets you start with the 1999 Major League Baseball roster and then guide your team through the trials and tribulations of a 162-game major-league season.

If you can keep your superstars healthy and the bull pen

in shape, you may even make the play-offs. To keep your play-off hopes alive when your players get injured or simply play badly, you can trade players with other teams. But be prepared to wheel and deal; the general managers, with AI (artificial intelligence), are tough negotiators.

HardBall 6 also comes with comprehensive scouting reports for all major-league players. If you think a player is overrated or underrated, you can simply edit the rating to alter his performance accordingly.

Don't like the way the leagues are run? Create a league of your own. Think your team is beyond repair? Build a brand-new team with imaginary players, or bring in an all-time team with heroes from the past.

Not only can you alter your lineups, but you can even create custom fielding strategies to fine-tune your defense. Put a "Ted Williams shift" on those hard-pulling sluggers you just can't seem to get out.

Whereas most other games stage a home-run contest, *HardBall 6* recognizes that it's also important to tune your infield and have your starting nine take batting practice. Though it's fun to let Mark McGwire put one into orbit in *HardBall 6*'s Home Run Derby, your diligence at the less glamorous Training Camp is what'll help you win the pennant.

HardBall 6's game interface displays all the joystick moves and buttons relevant to your players, so memorization isn't an issue. All the situational plays, such as the hit-and-run, are also right at your fingertips. Once you get the hang of managing the game, you can challenge another human player over a network (TCP/IP or LAN) or modem.

The game's stadium rendering is not impressive. The players' movements look like those of stick figures, and the play-by-play commentary isn't as animated as in other baseball simulations.

If you are willing to look past the aesthetics, however, you will

concentrated more on the appearance of the game and the players than on flow and control as a whole.

At the plate, most players look and swing alike, except for those with trademark batting stances, such as the New York Yankees' Chuck Knoblauch. We found it difficult to direct our batters to hit to all fields even when a situation called for it.

Baseball Edition 2000 does a better job with defense. Rather than simply running routine animations for fielding a

running and shoestring catches.

The game pace is slow, and the transition from the view of the batter hitting the ball to the fielding view is too abrupt. And though you can trade players, there is no drafting system for creating your own league. Lack of a network-play feature will disappoint those who want to compete against other humans.

Baseball Edition 2000 compiles thousands of stats for the fantasy baseball junkie to pore over during full-season mode. To keep up to date with the real-life



A League of Your Own

Baseball fans analyze and argue game statistics to no end. With the emergence of fantasy leagues on the Internet, rabid fans can use these stats to manage their own virtual teams. Picking a team isn't easy; you must stay under predetermined salary caps. Ideally, you'll select players who come cheap but end up playing great. Expensive sluggers can be risky: You never know when they'll have an off season.

CBS SportsLine USA Baseball Challenge (www.cbs.sportsline.com) and **Netscape Home Run Mania by SportsLine USA** (www.baseball21.com/misssioner.com/mo/solash/home?product=mania)

SportsLine USA created two free fantasy baseball services. In Netscape Home Run Mania you choose a team of nine sluggers (one at each position). Each week you simply tally up their home run counts. At stake are a \$5,000 grand prize and a \$100 weekly prize.

The SportsLine USA Baseball Challenge lets you draft and track 14 players. SportsLine USA paid close attention to the subtle details that

enhance fantasy managing. For example, there's a live scoring applet that keeps track of your players' performance in real time.

CNN/Sports Illustrated Fantasy Central (www.baseball.cnni.com)

Three fantasy leagues make up this site. Coach's Quest Baseball 99 is a fee-based league for serious fantasy buffs. It offers prizes, such as \$1,000 gift certificates from Steiner Sports Memorabilia. The two free leagues at the site are General Manager Full Season Baseball 99 and General Manager Mid-Season Baseball 99.

ESPN Baseball Challenge 99 (games.espn.go.com)

Use scouting reports and injury updates to pick a team. Prizes include a sports junkie's dream: a Sony big-screen television. The only drawback in ESPN.com's fantasy baseball is that you do not get to choose a pitcher, which takes an important element away from the game. —*SJY*



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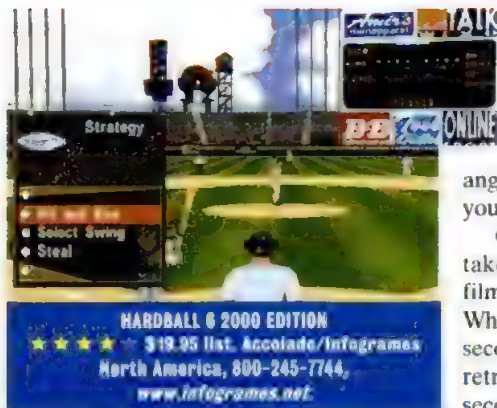
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AFTER HOURS



find that the game's attention to baseball's subtleties makes it worthwhile.—S/JY

High Heat Baseball 2000

PC MAGAZINE EDITORS' CHOICE

Lousy graphics and lame artificial intelligence helped make High Heat Baseball 1999 a disaster. The 3DO Company apparently got its act into gear during the off-season, however, and this year's follow-up, High Heat Baseball 2000, is a terrific game.

High Heat Baseball 2000 includes the standard 1999 Major League Baseball Association roster. It also has online multi-player capability, three levels of teams to manage in the Farm System, and 38 stadiums to play in. Ballparks include such classics as Ebbets Field and the Polo Grounds.

The AI is one tough opponent, handling players on the field and at the plate with skill. It actually performs squeeze plays and hit-and-runs at appropriate moments during a game.

Graphically, the players still look a little blocky, but their biomechanics are extremely realistic: Pitchers, for example, actually go for the rosin bag during extended pauses, and runners attempt to take out the shortstop during double plays.



What really sets High Heat Baseball 2000 apart, though, is authentic TV-like camera angles that help draw you into the game.

One notable angle takes a cue from the film *The Matrix*. When the shortstop or second baseman retrieves the ball at second base during a double play, the game pauses, rotates 180 degrees behind the infielder, then resumes as the ball is unloaded to first base.

Another plus is evident during the replay after a strikeout. A three-dimensional grid of the particular batter's strike zone appears, and as the ball is pitched through this zone, it lets you see the exact location of the ball.

Commentary comes courtesy of San Francisco Giants announcer Ted Robinson. Although less sarcastic and comical than Triple Play 2000's critiques, High Heat Baseball 2000's play-by-play is charming in a minimal yet direct and analytical way. Robinson even remembers how a player performs as a game progresses.

Though we would have liked to have seen a create-a-player option, the game does let you

customize existing players.

Despite a few minor glitches, High Heat Baseball 2000 is a superb baseball game that's worthy of a *PC Magazine* Editors' Choice award.—Roderick A. Beltran

Microsoft Baseball 2000

Microsoft Baseball 2000's 3-D graphics and sound effects rival the best in the baseball simulation genre. But there's not enough of an overall improvement over the previous version to challenge High Heat Baseball 2000.

The interface is much improved: The players' movements are more fluid and authentic, and this time, Microsoft has built in the Home Run Derby. But still lacking are some of the key subtleties that add to the realism and enjoyment of a baseball simulation game.

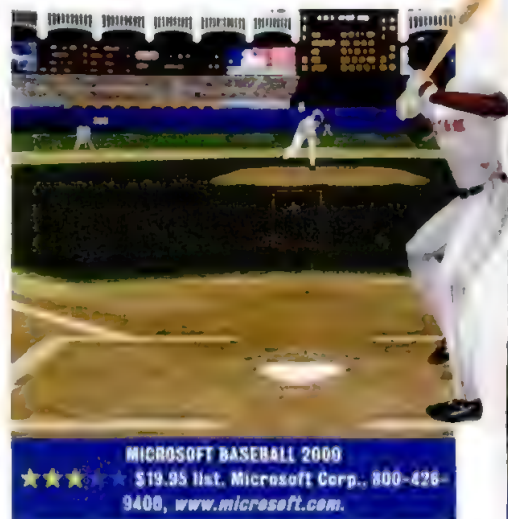
Baseball 2000 has the standard game modes: single game, home-run derby, full season, and play-offs. Although you can manage your team through a major-league season, you can't trade players in the process to enhance your play-off chances. Another element of reality that's missing is injuries or the status of players' health.

What Baseball 2000 lacks in logistical reality, it makes up for a bit with its authentically rendered ballparks and lifelike players with signature moves and batting styles. Well-produced crowd noise and cracks of the bat could fool you into thinking that you're really in a ballpark. In addition, the play-by-play of Thom Breneman (the voice of the Arizona Diamondbacks) is animated and energetic.

But such a level of visual and auditory realism comes at the

cost of system resources: Compare the 51MB of hard disk space required for a typical installation of HardBall 6 2000 Edition with the 316MB typical installation of Microsoft Baseball 2000. Despite copying so much onto the hard disk, the program accesses the CD-ROM quite often during game play, and the transitions between plays take some time, even on a Pentium II/400 system. Even with a 3-D accelerator, the scene play wasn't smooth as we would have liked.

The game offers three levels of difficulty and varying amounts of computer fielding assistance to accommodate all ranges of players. For example, the batting mode requires only



good timing in the beginners' mode. When you graduate to the intermediate level, you'll need to aim a box with a crosshair in the middle at the pitches. To make things more interesting, the advanced level lets you adjust your position in the batter's box. To reflect the batter's ability, the size of the box is proportional to his batting average.

Baseball 2000 is a well-produced game that is attractive and easy to enjoy. Serious baseball simulation game buffs, however, will quickly grow weary of its lack of advanced baseball subtleties and key features such as network play capability.—S/JY

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WINDOWS CE

PDA Games

By Bruce Brown

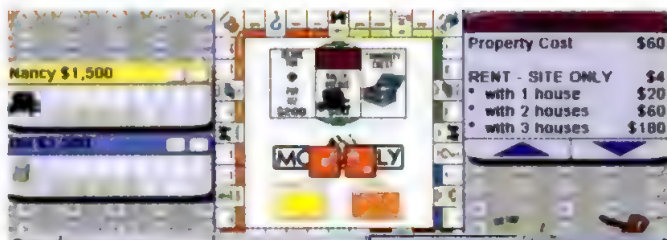
PDAs aren't just for organizing contacts and task lists. New games for Microsoft Windows CE hand-held PCs (H/PCs) and palm-size PCs (P/PCs) can be a lot of fun. 3Com Palm device loyalists, a considerably larger group than Windows CE aficionados, aren't excluded from playing games. Though perhaps not as much fun to play as games on a color-screen Windows CE PDA, Palm OS games can be diverting.

Hasbro Interactive has released four Windows CE versions of classic board games: Monopoly, Scrabble, Slingo, and

Trivial Pursuit (\$30 each, street).

Microsoft is now selling Microsoft Entertainment Pack 2.0 for Windows CE, a collection of 11 games (\$35 street). All of the tested games will run in color or gray scale on H/PCs but unfortunately only in gray-scale mode on P/PCs; the only game to date that supports color on a P/PC is good old Solitaire.

The new Hasbro games run in 640-by-240 or 480-by-240 resolution in 256 colors or 4-shade gray scale on H/PCs and H/PC Pros (Jupiter models) and in 240-by-320 mode on P/PCs, in 4-shade gray scale only. They scale nicely to all Windows CE screens except the NEC MobilePro 800's 800-by-600 screen, on which the game graphics are harder to



read, because they do not scale up to SVGA resolution.

Microsoft makes full use of Windows CE platform displays, even expanding to take advantage of the NEC MobilePro 800's 800-by-600-resolution screen.

Monopoly

You too can be a land-grabbing tycoon with Monopoly, Hasbro's Windows CE version of Parker Brothers' property-trading game. The Windows CE version



remains true to the board game, including realistic sound effects (be sure to turn audio off during meetings; the distinctive sound of rolling dice is a dead giveaway).

One to four human or computer-generated opponents can play at a time. Playing Monopoly on a PDA is easier than playing the board game: You can always see how much

Palm Games

Freeware and Shareware

The Palm Connected Organizer Game Collection (www.palm.com). This four-pack freeware download from 3Com Corp.'s Web site includes HardBall, MineHunt, SubHunt, and Puzzle. These are simple, general-interest games to get you started.

Tetris and Froggy are entertaining freeware games available from PalmCentral.com (www.palmcentral.com).

ZDNet's PalmPilot Software Library (www.zdnet.com/swlib/pilotsoftware) provides many shareware games, with Pocket Chess, Galax, and Hearts among the most popular.

Golf

Tiger Woods PGA Tour Golf for Palm Computing Organizers (\$30 direct) from Electronic Arts (www.easports.com) features three PGA Tour courses: Summerlin, Sawgrass, and Badlands Golf Club, where you play as Tiger Woods against other PGA golfers or against your friends. This game emphasizes the importance of planning your shots, and it includes a Swing Meter to adjust your electronic swings.

Infrared

Two-player IR gaming is fun for those who have Palm devices with beaming capability. Popular choices, such as IRGin (\$15 direct), IRChess (\$15 direct), IRCheckers (\$15 direct), and IR HangMan (\$15 direct), are offered by IR/Complete (www.incomplete.com).

Action

Fast and fun, Astroids (\$5 direct), from Astraware (www.astraware.com), blasts you into outer space for relaxation.

Dragon Bane (\$25 direct), from Palm Creations (www.palm-creations.com), holds your attention with wild terrain, imaginative creatures, and hidden treasures.

Classics

Classic games include Backgammon (\$15 street), from Stand Alone (www.standalone.com). Stand Alone also offers Bridge (\$15 direct) for one player against three computer players.

Try smallWare Solitaire (\$15 street), a 24-game set at www.smallware.com.

Palm users can also play a Trivial Pursuit-like game with Triv (\$15 direct), from RJen (www.rjen.com). It has 5,400 questions to challenge one to four players or teams.

Puzzles

Puzzle and word game loyalists will enjoy JStones and Jookerie (\$12 each, direct), from Land-HJ Technologies (www.land-hj.com). JStones is a challenging board game involving the intricate placement of stones on a grid. Jookerie players try to stump each other with definitions of obscure words.

In case you prefer crossword puzzles, Penguin Software (www.roadkill.com/penguin) offers Xword (\$10 street), which has an error feature to tell you whenever an incorrect letter is entered.

With Scramblet (\$15 direct), from oopdreams software (www.oopdreams.com), you create words from seven letters, betting against the clock and Wacky Wally, the dealer.

Game collections are another alternative. Pilot Goodies (\$35 direct), from Pilot Island Publishing (www.pilotisland.com), for example, includes 53 games in its bundle of over 200 Palm Connected organizer programs.



AFTER HOURS

money and which properties you and your opponents have in addition to the game board and the current player's turn. Also, property auctions and mortgaging go smoothly.

The screen is somewhat busy but informative. And the only downside is that you don't get to hold (and hoard) the play money.

Trivial Pursuit

Trivial Pursuit for Windows CE is based on 2,000 questions in the six categories used in the board game: People and Places, Art and Entertainment, History, Science and Nature, Sports and Leisure, and Wild Card.

One to four people can play Trivial Pursuit using either the Classic game rules or Point Pursuit, in which you earn points based on question category and difficulty level, as well as how long it takes to choose the correct answer.



The interface is clear and pleasing, because most of the screen area is devoted to the current question and multiple-choice responses.

Scrabble and Slingo are of the same quality as Monopoly and Trivial Pursuit.

Microsoft Entertainment Pack 2.0 for Windows CE

Microsoft Entertainment Pack 2.0 for Windows CE includes 11 games: card games, word

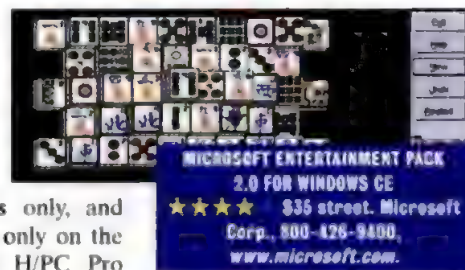
games, board games, and PDA versions of classic video and computer games.

Six of the games—Black-jack, Chess, Free-Cell, Minesweeper, Space Defense, and Taipei—run on H/PC or H/PC Pro devices in monochrome or color and on P/PCs in gray scale only. Three games—Hearts, Reversi, and Sink the Ships—support the same platforms and display modes but add the ability to play opponents on other Windows CE devices via infrared connection.

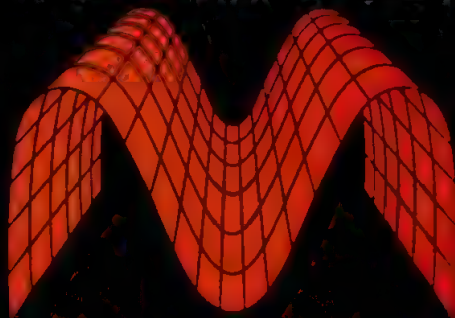
Two of the games are platform-specific: Cinco is a word game for palm-size PCs only, and Codebreaker runs only on the larger H/PC and H/PC Pro

devices. The Microsoft Windows CE games, like the Hasbro ones, use the audio capabilities of the Windows CE devices for minimal sound effects.

The Microsoft games in general are not as complex and sophisticated as the Hasbro games, which is a fair trade-off, given that a single Hasbro title costs about the same as the full set of Microsoft games. Although the Microsoft games aren't overly engaging or demanding, they're just right for passing the time while you wait to catch a flight or commute by train. **PC**



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Is software as we know it dead? Everything from calendars to enterprise resource-planning software can now be used with only a Web browser on the desktop. We'll explore this emerging trend and how it'll affect your business, spotlighting the applications that you may soon rent instead of buying.

E-Mail for Rent

If e-mail isn't your business, why not bring in the experts? Their reliable services come at a cost you'll be hard-pressed to match. But if you insist on doing it all yourself (there are plenty of good reasons to do so), check out our comparison of Internet-standard e-mail servers and proprietary groupware solutions.

Your Personal Printer

Whether it's an ink jet, a laser, or a multifunction personal printer you're interested in, you'll find that prices are low while image quality and features are top-notch. We'll review 55 personal printers to give you all the facts.

Get Ready for Takeoff

After Hours will show off the latest flight simulators.



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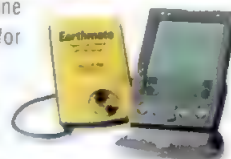
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The Journey of Hope.

It's said that even the longest journey begins with a single step. If that's the case, Starlight Children's Foundation has already put thousands of miles behind them. As a premier children's charity, Starlight Children's Foundation improves the quality of life of seriously ill children and their families through in-hospital entertainment programs, and out-patient programs and services.

ViewSonic® applauds Starlight's humanitarian mission. And we're joining them. Throughout the coming year, the ViewSonic hot air balloon will travel across the United States and Canada as part of a program we're calling the Journey of Hope. We'll be joined by a generous group of corporate partners, all working toward the goal of raising awareness, visibility, support—and most importantly—funding that will assist Starlight Children's Foundation in helping North America's children in need.

It's the kind of thing good neighbors and good corporate citizens must do. We hope it helps and we hope you'll come out and take part when the Journey of Hope tour visits a city near you.

August 10	Washington D.C.
August 17	Boston
August 31	Denver
September 17	Seattle
September 25	Napa/San Francisco
October 3	Albuquerque
November 15	Las Vegas

If you would like to make a donation to the Journey of Hope on behalf of Starlight Children's Foundation or for more information about the Journey of Hope, visit us at www.ViewSonic.com or contact Starlight Children's Foundation at www.starlight.org.

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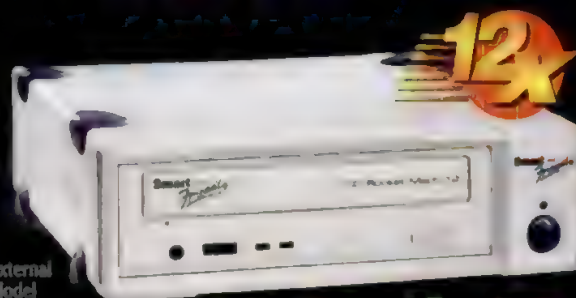
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CTUTM44B	AMD K6-300MHz	15"	32MB PC 100	4.3GB UDMA	24X	PCI/2MB	AT	Mid-Tower	\$17/Month	\$549.99	\$149.99
CTUTM55A	AMD K6-2/400 3DNow!	15"	64MB PC 100	6.4GB UDMA	32X	AGP/8MB	ATX	Micro-ATX	\$25/Month	\$599.99	\$199.99
CTUTM56A	AMD K6-2/475 3DNow!	15"	64MB PC 100	8GB UDMA	40X	AGP/8MB	ATX	Micro-ATX	\$23/Month	\$679.99	\$279.99
CTUTM50A	Celeron 400MHz	15"	64MB PC 100	8GB UDMA	32X	AGP/8MB	ATX	Mid-Tower	\$23/Month	\$699.99	\$299.99
CTUTM57A	AMD K6-2/400 3DNow!	15"	128MB PC 100	13GB UDMA	40X	AGP/8MB	ATX	Micro-ATX	\$23/Month	\$739.99	\$379.99
CTUTM51A	Celeron 500MHz	15"	96MB PC 100	8GB UDMA	32X	AGP/8MB	ATX	Mid-Tower	\$26/Month	\$829.99	\$429.99
CTUTM29B	Pentium III 450	17"	64MB PC 100	8GB UDMA	40X	AGP/8MB	ATX	Mid-Tower	\$30/Month	\$899.99	\$699.99
CTUTM39	AMD K6-III/400 3DNow!	17"	128MB PC 100	13GB UDMA	40X	AGP/8MB	ATX	Mid-Tower	\$30/Month	\$949.99	\$549.99
CTUTM42B	Pentium III 450	17"	128MB PC 100	13GB UDMA	40X	AGP/8MB	ATX	Mid-Tower	\$30/Month	\$999.99	\$599.99
CTUTM47	AMD K6-III/450 3DNow!	17"	128MB PC 100	20GB UDMA	40X	AGP/8MB	ATX	Mid-Tower	\$34/Month	\$1099.99	\$699.99
CTUTM43B	Pentium III 500	17"	128MB PC 100	13GB UDMA	40X	AGP/8MB	ATX	Mid-Tower	\$39/Month	\$1099.99	\$699.99
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CTRTM46A	Pentium III 600	17"	128MB PC 100	20GB UDMA	40X	Voodoo 3 AGP/16MB	ATX	Mid-Tower	\$50/Month	\$1649.99	\$1249.99

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Page 39

Windows Smashes Baseball

Faithful reader Greg Searle was enjoying a minor-league baseball game in Lowell, Massachusetts, when the announcer's voice was suddenly drowned out by that familiar Windows boot-up *bbbrrrrringg*. Now we know what kind of software they use to drive the sound-effects system.

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Yeah, right. Why blame the programmers
when you can blame God?
(Brigade Quartermasters catalog.)

No Big Surprise

Why were we not surprised to find this
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